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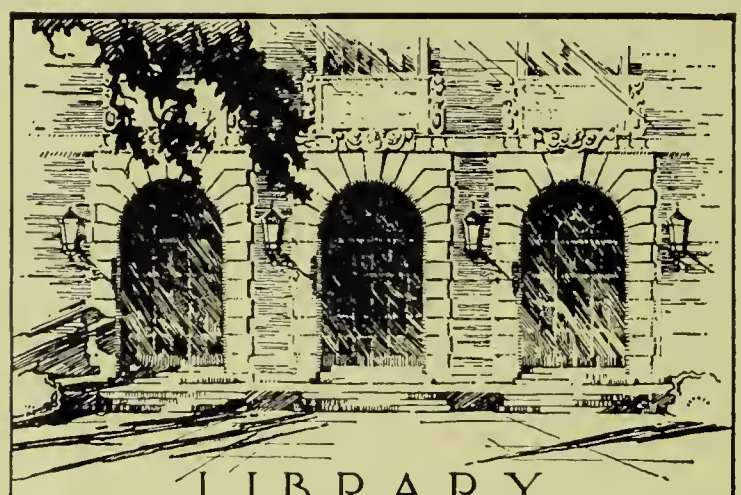

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PART I.

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PREFACE.

The two previous volumes of Studies from the Institute of Medical Research were each on a special subject, Malaria and Beri-Beri respectively.

In this, the third volume, the plan of in each volume treating a separate subject has been abandoned, both because it has not been found practicable to so complete the study of any subject as to attain finality, and also because it has been necessary to make a partial study of so many subjects connected with the Public Health.

Many of these investigations are merely preliminary, but enough has been done to show that the local study of local conditions is a necessity for economically dealing with sanitary questions.

The application of general principles on lines advantageously adopted elsewhere requires for local needs much modification, and unless the knowledge is obtained of local conditions waste of money and inefficient sanitation will occur in the future as they have done in the past.

The present volume is divided into four numbers:—

No. 1 deals with observations made on the commoner diseases of men and animals.

No. 2. A preliminary report on the natural waters and the effects of methods for purification adopted.

No. 3 gives the results of an enquiry into the Culicidæ of Malaya.

No. 4 is an account of observations made on the epidemics of Rinderpest in Selangor in the last eighteen months, with an account of clinical characteristics of the disease.

An extra number on Beri-Beri will, it is hoped, be published later.

C. W. DANIELS,
Director, Institute for Medical Research, F.M.S.

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Animal Parasites in Man and some of the Lower Animals in Malaya.

Many observations have been made on the presence of various animal parasites, but our knowledge of their occurrence in Malaya, of their life histories and of their effects on their hosts is still far from complete.

PROTOZOA.

Of the four great classes the Sacodina are represented by the Amoeba Coli. This Amoeba is common in some of the forms of dysentery, but is only occasionally met with in other forms. It has not been found by us except in association with ulceration of the colon or in the Intestine. It was found in all cases of Hepatic abscess examined. Attempts at cultivation either in artificial media, in flies and in larvæ failed.

Infusoria.

Paramoccium Coli and various other ciliated organisms were found in dysentery and occasionally in loose stools where there was no proof of ulceration.

Mastigophora.

In man were only represented by flagellate intestinal organisms, *Balantidium Coli*, in certain cases of dysentery. Trypanosomes in man were not found. In a horse Trypanosomes were found in large numbers and the animal died in a few days. Clinically all the symptoms of "Surra" were present. Guinea pigs injected with the fresh blood of this horse died in three months. Numerous trypanosomes were found in their blood. The animal had been in the States for two years and must therefore have become infected in the country. No previous case could be discovered, and it appears probable that a less susceptible animal than a horse had introduced the disease. In the course of numerous examinations of cattle, similar, though somewhat larger parasites were found in the blood of a buffalo (Siamese) recently imported. It is not improbable that as these animals are almost insusceptible to the effects of the parasites that the disease is occasionally imported in them from countries where "Surra" is endemic, and may in turn infect susceptible animals such as the horse in this instance. No Glossina are known here, but there are numerous species of biting flies.

It is difficult to see how such an importation could be prevented.

Sporozoa.

This class is well represented, and the members of it are the causes of numerous diseases both in man and in the lower animals.

Malarial Parasites are widely but not uniformly distributed. The distribution of the different species as seen in the District Hospital in Kwala Lumpur are shown by Dr. McCLOSKY to be as follows :—

MALARIA AT THE DISTRICT HOSPITAL, KWALA LUMPUR, DURING 1903,

BY A. J. McCLOSKY, M.B., C.M., EDIN.

1. Microscopical examination of the blood of all cases of Malaria was made at the Institute for Medical Research, and a diagnosis made according to the parasites found.

2. Two hundred and fifty-three cases were treated during the year, classified according to the following types: Malignant, Quartan, Benign Tertian and mixed types.

The following table shows the number and percentage of each type and compared with the preceding year :—

TYPES.	1903.		1902.	
	Number.	Percentage.	Number.	Percentage.
Malignant	136	53·73	77	43·57
Quartan	79	31.22	55	30.72
B. Tertian	26	10.27	41	22.9
Malignant and B. Tertian ...	10	3·95	3	1.14
,, ,, Quartan	1	·39	1	·55
B. Tertian and Quartan	1	·39	2	1.11
TOTAL ...	253		179	

There has been a marked increase of Malaria this year as compared with the previous year. This increase is mainly due to the large number of admissions from amongst the coolies working at Ulu Gombak. The order of prevalence of the different types of fever is the same for both years, and does not correspond with that given by Dr. HAMILTON WRIGHT in his Study No. 1, in which the Benign Tertian is shown to be more prevalent than the Quartan Type.

3. The districts from which most of the cases came are as follows:—

		Quartan.	B. Tertian.	Malignant Tertian.	Per cent. 4 Quartan.	3 Tertian.	1 Mal. Tert.
Kwala Lumpur ...	66	20	13	33	30·3	19·0	50
Gombak	45	12	3	30	26·6	6·6	66·6
Ampang	28	9	1	18	32	3	64
Kepong	12	5	1	6			
Panthai	10	1	2	7			
Pudoh	8	2	—	6			
Ulu Klang	7	1	1	5			
Sungei Besi	7	3	—	4			
Simpang	7	1	2	4			
Setapah	6	1	—	5			
Kajang	9	6	1	2			
Total ...	...	...	...	...	29·7	11·7	58·5

The particular streets in Kwala Lumpur from which the patients came could not be ascertained in all cases, but those obtainable were as follows:—

Batu Road, 18; Java Street, 11; Brickfields, 8; High Street, 3.

The following table shows the monthly admissions and rainfall:—

	1903.		1902.	
Months.	Admissions.	Rainfall.	Admissions.	Rainfall.
January	17	4.99	17	2.76
February	15	3.68	6	9.43
March	19	9.19	7	6.91
April	28	7.03	13	13.71
May	20	13.81	10	9.99
June	25	4.40	12	6.99
July	21	1.97	14	3.19
August	12	6.70	17	7.46
September	22	4.51	22	5.48
October	18	11.58	17	18.18
November	19	8.82	11	19.48
December	25	12.55	10	11.80
Total ...	241	89.23	166	115.38

The only deduction which can be drawn from the above table is that in each year the month in which the rainfall was lowest, viz., July and January respectively, was followed by the month in which the admission rate was lowest.

The following table shows that in the past two years there has been no great seasonal variation in the prevalence of the parasities:—

Months.	Malignant.	Quartan.	B. Tertian.	Malignant and B. Tertian.	Malignant and Quartan.	Quartan and B. Tertian	Total.	Malignant.	Quartan.	B. Tertian.	Malignant and B. Tertian.	Malignant and Quartan.	Quartan and B. Tertian.	Total.
January	6	7	4	..	..	..	17	4	8	5	..	..	..	17
February	5	6	4	..	..	..	15	8	4	4	..	..	..	16
March	8	8	3	..	..	..	19	3	1	2	..	..	1	7
April	11	11	2	3	..	..	28	7	4	3	..	..	..	14
May	7	7	1	3	..	1	20	3	4	2	..	..	1	10
June	14	10	1	..	..	..	25	7	2	2	1	..	..	12
July	15	3	1	1	1	..	21	2	..	12	..	..	..	14
August	10	1	1	..	..	..	12	12	4	1	..	..	..	17
September ..	14	5	1	2	..	..	22	15	5	..	1	1	..	22
October	15	2	1	..	..	..	18	8	7	2	..	..	..	17
November ..	12	6	1	..	..	..	19	2	3	5	1	..	..	11
December ..	18	4	2	1	..	..	25	1	9	..	..	..	..	10

Admissions of the Malignant type were more numerous during the last six months of the year, as the following figures show:—

	1903.	1902.
1st six months	51	33
2nd ,, ...	84	43

Malignant Parasite.—This is the most common parasite met with at the District Hospital. Doubly infected corpuscles were frequently met with, and I have seen as many as five parasites in one corpuscle. Examination of fresh blood films showed (1) young active amœboid forms; (2) quiescent ringlets with and without pigment, pigment generally active, as fine granules or rods; (3) brassy bodies; (4) crescents and globular bodies of the crescent series.

Quartan Parasite.—Single infections are more common than in the Malignant and B. Tertian fevers. Fifty-three per cent. of the cases were single infections. Out of 41 cases, 22 were single infections, 11 double and 8 triple. Examination of fresh blood films showed (1) young active amœboid forms; (2) pigmented parasites, pigment sluggish and in form of fine rods; (3) corpuscles not enlarged and not changed in colour; (4) sporulating bodies.

Benign Tertian Parasites.—Double infection is common. Out of 21 cases, 14 were double and 7 single infections.

Examination of fresh blood films showed (1) young active amœboid forms; (2) pigmented parasites, pigment very active and in form of fine granules; (3) hosts enlarged and pale; (4) sporulating bodies; (5) extra corpuscular forms; (6) small free pigmented bodies with the pigment very active.

It may be noted that the prevalence of Quartan shown in Dr. McCLOSKY's report is not universal throughout the Federated Malay States. It is rare in Kwala Lumpur amongst Europeans and amongst the better class natives who are admitted to the General Hospital. Out of 255 cases in which the blood was examined the proportions were Quartan, 2 per cent.; Tertian, 40 per cent.; and Malignant Tertian, 58 per cent. It is rare in other districts such as Klang.

Dr. H. WRIGHT (The Malarial Fevers of British Malaya Studies from the Institute for Medical Research, No. 1, Vol. 1) gives out of 251 cases percentages of 22.3 per cent. Quartan, 31 per cent. Benign Tertian, and 46.2 per cent. of other types.

Of the cases of Malaria treated at the District Hospital only 28.8 per cent. were from Kwala Lumpur. Of the remainder 45 or 23 per cent. of the total were from Gombak, a district where extensive works in partially cleared jungle are being carried out. Under such circumstances in Malaya Malaria is as severe and prevalent as in bad parts of Africa.

The variation in the distribution of anopheles is dealt with fully elsewhere.

CONDITIONS FAVOURING PREVALENCE OF MALARIA.

The conditions under which Malarial Fever becomes epidemic in Malaya vary. In large towns it occurs but only as isolated cases or small groups of cases.

The more important places are:—

(1) Where extensive works are undertaken in jungle.
(2) In the low lands at the mouths of rivers and near the sea.

Of the first class the works in connection with the Electric Power Station at Gombak may be taken as an example. This place is of particular interest as it is one of those reported to be free from mosquitoes. It is so to the extent that mosquitoes are not troublesome, are rarely found in the houses, and that mosquito curtains are unnecessary for comfort only. Examination of breeding places shows that mosquitoes are widely distributed, and in particular that an anopheles, *Anopheles Treacherii* is to be found in every stream, and that other anopheles *Myzomyia leucophyrus*, *Lophoscelomyia asiaticas*, etc., are also to be met with in places. Anopheles Treacherii dies rapidly in dry air and is only found in streams in jungle. These streams are often rapid, and in hilly and rainy districts, such as Gombak, vary in size from mountain torrents to a mere trickle in the space of a few hours.

The huts—bangsals—were situated at the edge of the clearing in the jungle and close to one or more of these streams. In most cases the clearings were very small and incomplete.

In these huts men from all parts of China, India or the Malay Peninsula, slept crowded together without any protection against mosquitoes.

Our statistics here show that adult Chinese are not immune to any form of Malaria any more than adult Europeans, Asiatics, Americans or Africans are unless reared and living in a badly malarious district.

Most of the men are Chinese highly susceptible to Malaria, and amongst them will always be some who are harbouring malarial parasites. From these the mosquitoes, which are not numerous, become infected and in turn infect every susceptible person they bite. So great is the liability to infection that in three instances to my own knowledge a single night's residence was followed in 10 days by an attack of Malaria. Children play no part in the propagation of Malaria, it is entirely a question of infected adults infecting, *viâ* mosquitoes, other susceptible adults, as there are no children at such camps.

It will be noted that no question of drainage, filling up of pits, etc., can arise in connection with these mountain streams. Something might be done at considerable expense by clearing the course of the streams, but as these streams are running over masses of granite or between granite boulders it could not be economically undertaken for temporary stations.

In some instances artificial obstructions to the streams are made in the course of felling the jungle, and portions of the streams in the vicinity of the huts are often dammed up for bathing and other purposes. Such practices should be avoided.

Mosquito curtains in a place where mosquitoes are not troublesome are not satisfactory, as it is impossible to enforce their use on persons who are engaged for short periods only. A. Treacherii is a very small mosquito, and when confined in mosquito nets sometimes passes through.

Advantage should be taken of the inability of the imago to live in dry air. More extensive clearings on all sides of the huts and drier houses will render the human habitations unsuitable for these mosquitoes.

Such measures were partially undertaken at Gombak and for some months the amount of Malaria was much reduced. As the growth of the imperfectly cleared land recurred the returns were nearly as bad as at first.

Work under similar conditions has been attended with very heavy mortality and much Malaria in many parts of the Malay States. It will continue to do so till good clearings are made and maintained for the labour employed on such works.

The contract for such clearings and camps and the labour employed on the clearings and other sanitary work should be distinct from the contracts and bodies of men employed on the works themselves. Experience has shown that with the desire to expedite works all available labour if under one authority is diverted to that work and sanitary undertakings are neglected.

The second class of place of great importance is that occurring on extensive flat swampy areas near the coast or towards the mouths of rivers.

Here the conditions as regards housing of labour may or may not be similar to the temporary camps established in the jungle. In any case conditions for introduction and spread of Malaria are present, and susceptible individuals abound.

The level of the subsoil water is high, pools are formed with each shower and many of them are permanent. In any engineering undertaking it is common to find that roads, railway permanent way or embankments are made without due regard to the necessity of maintaining the natural system of drainage or of providing a superior one. In the making of these embankments "borrow pits" are made in numbers and no provision made for their drainage.

Under these circumstances mosquitoes of many genera abound, and amongst these are several species of anopheles though not the species prevalent in the jungle.

Drainage of such areas presents no real difficulty, and where a permanent station is to be formed is economical as well as successful.

This is well illustrated by the success which has attended this method of dealing with the matter at Klang and Port Swettenham.

Two areas were treated. One consisted of swampy ground near the coast through which the Klang River passed. This region is partially closed in by a semicircle of hills. The second was flat land and mangrove swamp on the coast flooded at high tides.

During clearing of the mangrove there was a certain amount of Malaria amongst those employed.

When a railway embankment was built there was great interference with the natural drainage and the swampy areas were increased, rendered more permanent, and protected to some extent from flooding by sea water.

A great increase in the number of cases of Malaria occurred so much as that between September 15th and November 25th, 1901, out of 260 inhabitants of certain quarters and shop houses 158 or 60 per cent. were attacked. In the township of Klang, some $2\frac{1}{2}$ miles up the river at the foot of the hills and very swampy, Malaria was also rife.

A Government Commission composed of three engineers and three medical men was appointed, and as a result of their enquiries extensive carefully devised measures were undertaken at a cost of some £3,500. The results were highly satisfactory. In the last quarter of 1901 the admissions for malaria for the two townships were 252; for the same period in 1902 they were only 26. Full details are given in the reports by Drs. Travers and Watson.

These satisfactory results were obtained although the drainage was not complete, and there is no difficulty in still finding places, especially during wet months, in which anopheles larvæ can still be found. Dr. Leicester has shown that the species of Anophelina in the drained area does not correspond to those met with in the undrained, and that the great majority of larvæ found in the districts treated are now the comparatively harmless M. Rossii, whilst other species not found in these areas abound in the surrounding untreated district.

The effect of the drainage has not only been to diminish the number of breeding places, but also to exclude certain species. The measures adopted have reduced the amount of Malaria and the deaths from Malaria in hospital from 52 in 1901 to 9 in 1902, and still more the general death rate, whilst there has been no reduction in these rates in the surrounding district.

This has been accomplished by the adoption of measures which aimed at reduction and not at abolition of breeding-places in the respective areas. A certain amount of up-keep is required, and it is to be anticipated that

further measures which can gradually be adopted will still further reduce the amount of sickness.

An exact knowledge of breeding-places of mosquitoes in Malaya shows that in such situations partial measures are successful, as under such conditions only poor carriers of Malaria abound, as *Myzomyia Rossii*. Under similar conditions in Africa more complete measures would be required as *Pyretophorus costalis*, a good carrier of Malaria, which is not found here would thrive.

In spite of this object lesson and the publicity given by the Government to the results obtained, it is noteworthy that similar insanitary conditions to those made at Klang and Port Swettenham are still being artificially produced in many parts of the country. Undrained "borrow pits," holes for brickmaking in the vicinity of houses, drains, embankments and roads which interfere with drainage are not only left unaltered but the number of them is daily being added to.

It should be a matter of no surprise to find that the first result of "opening up of new ground" is a large increase in the amount of Malaria, and the more these undertakings are in charge of Europeans—the more thoroughly the work is done—the greater the probability of this increased unhealthiness.

Another method by which the number of breeding-places is artificially increased is that in which a water course is dammed up in order to divert a stream for mining, irrigation or other purposes. Such a dam necessarily causes a backing up of the water behind it, a rise in level of the subsoil water and frequently flooding of low lying lands in the neighbourhood of streams. A good example of these conditions is to be seen at Seremban, and from near areas so flooded even in dry weather, most of the cases of Malaria, according to Dr. MILNE, are derived.

CONTRAST WITH CONDITIONS ELSEWHERE.

A contrast with the conditions in Central and East Africa and those in Malaya is of interest. None of the anopheles in the one country are found in the other. The most dangerous African anopheles, *Myzomyia funesta*, is a stream breeder, but it breeds freely in streams and rivers passing through open country, and can travel freely in a dry atmosphere for certainly several hundred yards. No clearing of jungle or building of dry houses is of any avail against this mosquito, and the numbers can only be reduced by clearing the beds and banks of streams. Beyond this reliance has to be placed on the use of mosquito nets and quinine.

The other African mosquito of most importance is *Pyretophorus costalis*, which, though it is found in pools and streams, seems to be most abundant in any stagnant water and particularly in shallow rock or other pools near human settlements. It breeds under much the same conditions as the harmless *Myzomyia Rossii* in Malaya. These correspond to our coast conditions, and where effective drainage can be undertaken and maintained this is the successful economical and permanent settlement of the question.

In Southern Europe the important carrier is *A. maculipennis*, and this mosquito breeds under varied conditions including those suitable in this country for *M. Rossii*.

In Malaya fortunately simpler and less complete measures are required than in Africa or in Europe, on account of the different species which are dangerous in the three continents. The prevention and diminution of Malaria is therefore comparatively easy.

Fatal Malaria.

In a considerable number of cases at the autopsy there was evidence of old or recent Malaria in the shape of pigmentation of the spleen or liver.

In those in which only a few parasites were present Malaria, though possibly a contributory cause of death, could not be considered as the main cause. In some of these, as in one case of Quartan Malaria, Beri-Beri was detected during convalescence from the attack of fever. There was no recurrence of the fever and no parasites, but abundant malarial pigment was found at the autopsy and the patient died of Beri-Beri.

In two of the cases in which death was attributed directly to Malaria there was some tubercular disease of the lungs. In the one case as an old wrinkled sclerotic mass surrounding some cretaceous nodules at one apex, and in the other recent tubercular infiltration affecting only a small part of the apex of one lung.

In three cases Dysentery and Malaria co-existed, and as clinically the dysenteric symptoms masked those of Malaria these cases in which death was probably the result of the combination are excluded from the table as well as one case of advanced anæmia with sloughing cellulitis of the leg. Of the remaining 15 cases in all parasites were found in large numbers in cerebral and other capillaries, and they are considered as fatal cases of Acute Malaria.

The parasites found in all were the so-called Autumnoæstival or Malignant Tertian parasites.

The ages of the patients when ascertained were as follows:—Two, 25 and under; four, 30 and under; two, 35 and under; two, 40; and two over 40: a difference from the proportions dying at various ages in this hospital in that twice as many were in the most active life periods under 35 as over it, whilst the ordinary proportion amongst the fatal cases of disease was equal under and over.

Fatal cases occurred amongst patients from Kwala Lumpur from the mining districts and particularly from Gombak, where extensive engineering works are being undertaken.

Four died within a few hours of admission, and five more within three days. Four lived a week and over a week. Of those not dying within the first day Quinine in 10 gr. doses was given two or three times a day in several cases, and in some of these the temperature became normal, and remained so in one case for three days before death. Though the symptoms were thus reduced the large number of active and sporulating parasites found in the capillaries showed that the treatment had not been effective in the sense of destroying or preventing the development or reproduction of the parasites in these cases. In other cases the rapid and complete recovery and the prolonged disappearance of parasites of the same type from the blood under the same treatment shows that such treatment may be and often is effective.

This variation in the effect of small or medium doses of Quinine though well known is not easily explained in the ordinary theory of mere poisonous

action of Quinine dissolved in the blood serum on the parasites. The result of giving large doses where small doses fail and even increasing both the frequency and the amount of the doses in severe cases almost to an unlimited extent is usually found to be highly satisfactory. In two of the fatal cases intramuscular injections of 5 grains were given every two in one case and every 3 hours in the other on the day on which death occurred.

Coma was not present in all the fatal cases; death in several seemed to be the result of collapse or slow cardiac failure.

Intense congestion of the alimentary tract was present in three cases and in one other, though neither ulceration nor marked congestion was found at the autopsy blood had been passed per rectum in quantities two days before death. The frequency of Epistaxis in Malaria is well known.

The two organs most commonly enlarged in Malaria are the liver and spleen. In these cases the average weight of the spleen was 476 grams., in two cases it was under 300 grams., and in three under 400; in two it was over 700, in one over 600, and in four over 500. As the normal weight varies from 150 to 250 grams., it will be seen that the enlargement was slight in two and moderate in three more and in none extreme.

As compared with the cases of Enteric occurring in the same race, Chinese, there is little difference, as in these the average weight was 380, one of the spleens being only 190 grams. The others were respectively 270, 435 and 635 grams.

In the malaria cases the average weight of the liver was 1,568 grams., or little above the average normal weight, and in only four was it over 1,800 grams., two were under 1,200 grams.

The enlargement of the liver is far less marked than in Pneumonia, but slightly more than in the Enteric cases here, as these had an average weight of 1,505 grams.

There were no cases of Hæmoglobinuric (Blackwater) Fever, even from the intensely malarial Gombak district. At Klang, near the coast, one case was reported by Dr. Watson. The course of the disease and the character of the urine were similar to those in a mild attack of Blackwater Fever in Africa.

The so-called Leishman Donovan bodies were not observed. No cases clinically resembling the disease associated with these parasites were seen by me.

I am informed that amongst Tamil immigrants cases do occur with the association of enlarged liver and spleen and irregular pyrexia unaffected by Quinine. These have not been seen by me or examined for these bodies.

Piroplasmosis.

The most important of the sporozoa affecting the lower animals here is the *Piroplasma Bigeminum*. In 4 out of 13 Siamese cattle convalescent from Rinderpest these were found, but in very small numbers.

Subsequently Dr. Leicester made a larger series of examinations and found as follows:—

Dr. Leicester's Examinations.

1st Series.—12 Siamese bullocks.—11 had Rinderpest, and in 9 Pirosoma were found, including one which recovered. One was never ill and no pirosoma were found.

2nd Series.—15 bullocks.—1 Siamese, 3 cross between Siamese and Indian, 10 Indian and 1 calf. Of the Indian 7 had Rinderpest and 5 recovered. Pirosoma were found in all. There did not have Rinderpest, and 2 of these had Pirosoma. The calf also had Pirosoma. Of the three half breeds all had Pirosoma.

This gives a total of 27 cattle of mixed breeds with 23 infections, or 85.1 per cent. When it is remembered that many of the infections were so small that prolonged search was required to find a single parasite this percentage is probably below the real number indicating the proportion of infected animals, and indicates that practically all cattle here are infected with the parasites.

The state of affairs appears to be very similar to that found by Koch in East Africa. There is a general infection of the cattle. The animals in their normal condition harbour the parasites only in small numbers and are insusceptible to the effects. When much reduced as by an attack of Rinderpest the parasites increase, and this secondary infection or rather exacerbation occurs and appears to be a cause of part of the mortality from Rinderpest. The animals die in reality from the combination of the two diseases.

A still more important point is the liability to severe infection of cattle imported from many parts of Australia. These imported cattle are known to be highly susceptible to the disease.

In one of these imported animals a severe attack of typical "redwater" or "Texas" fever was observed, and Pirosoma were found in the blood. It is a common experience that such imported cattle frequently die within a few months after arrival in the country.

The matter is a serious one as it will be difficult to improve the breed of cattle here unless care is taken to import cattle only from places where the disease is endemic and the animals have acquired immunity.

Other imported cattle should not be allowed to graze on land that has been grazed on by the native, Siamese or Indian, cattle, as the ticks, the definitive hosts, of the disease abound and many must be infected. The ticks found on cattle appear to be the Australian Species *Boophilus Australis* and not the *Boophilus Bovis* which carries the disease in America and Europe.

The precautions required are so elaborate and would be so difficult to carry out that the importation of such animals should be avoided.

Other Protozoa.

Hæmosporozoa were found in several species of monkeys. They resemble the subtertian parasite of man but the gamete forms are spherical. In a flying fox Dr. Finlayson found parasites which closely resemble those found by Dionisi in bats in Italy. They resemble the gamete forms of human Quartan Malaria. Halteridium occurs in several species of birds. Proteosoma were not found in the sparrows. Probably this is related to the scarcity of Culex Fatigans except in the vicinity of the more permanent settlements.

One case of Relapsing Fever was observed by Dr. Fletcher. Spirilla Obermeieri were found in large numbers. The patient was from Northern India and had only been a few days in the country so that he brought the disease with him. He had a single attack and no relapse. The disease has not spread.

In frogs of several species and in a crocodile Drepanidia were found. Those in the crocodile were peculiar on account of the extensive vacuolation. No extra corpuscular forms were observed. They displaced the nucleus of the red corpuscles in a manner similar to that of one species found in frogs, but otherwise have no close resemblance to those parasites.

Coccidium Oviforme is found in the majority of rabbits either imported or bred in the country.

Sarcosporidia in large numbers were found in the cardiac muscle of an imported Australian bull which died some three months after arrival in the country. At first the animal appeared to be in good health but then commenced to get "fever." Texas fever was suspected, but though numerous examinations were made the pirosoma was never found. Irregular though less severe fever continued for nearly up to the time of death, and the animal steadily lost weight and condition. The immediate cause of death was intercurrent disease Acute Pleuropneumonia and Pericarditis.

Helminths.

The number of intestinal and other worms met with in lower animals in the Malay Peninsula was very large. As none of these seem to attack man or the domesticated animals, only those found in man and domesticated animals are, with a few exceptions, here considered.

As regards the presence of these parasites in man it must be borne in mind that they are not necessarily indigenous, as the greater number of the examinations were made on Chinese or other imported races of mankind, and that the greater number of domesticated animals are also imported. As, however, these parasites, even if introduced originally, may become widely diffused, the importance of their occurrence is or may be great.

Platyhelminths.—In man the Trematodes are represented by Distoma Sinense, *Opisthorcis Sinensis*, which has been found on several occasions, five out of 328, in the gall bladder or bile ducts of Chinese residents. Though the bile ducts are often much distended these parasites do not cause symptoms of obstruction or apparently produce any serious disease. Ova of these worms have been sent from other parts of the States so that it appears to be widely diffused amongst the Chinese now resident here. In the lower animals Trematodes are more common.

Mr. Ford, Government Veterinary Surgeon, has observed in Bullocks and Buffaloes *Amphistoma conicum* at almost every examination of the rumen of these animals. In one bullock unusually large, 35 mm., specimens of the *Distoma Hepaticum* readily recognised by the cuticular prickles were found in the liver. From another bullock he forwarded to me a specimen of the spleen with the venous cavities dilated with innumerable specimens of *Bilharzia Crassum* (Schistostoma Crassum). There is no reason to believe that this parasite is common. The human species of the Schistostoma appears to be unknown here. No other organs were forwarded for examination, but as the spleen is an uncommon place for the accumulation of this

parasite it probably also occurred in numbers elsewhere. The new Schistostoma, *Schistostoma Cattoi* (Blanchard) discovered in the body of a Chinaman in Singapore has not been found here.

Cestodes.

No tape-worms were found at any post-mortem examination or observed during life. This is somewhat remarkable considering the fondness of the Chinese for pork. The care exercised by the Chinese in the feeding of pigs is probably their safeguard.

In one buffalo calf observed by Mr. Ford segments of a large tape-worm, probably *Tænia Expansa*, were passed.

In dogs, *Tænia Cucumerina* (Dipylidium Caninum) is common. One incomplete specimen of a Bothriocephalus was received by me from Mr. Ford. The segments were nearly mature and crowded with ova. There was no head. The yellow colour and the size, 4 to 5 mm. in breadth and 1 to 1.5 mm. in length, is compatible with the Canine *Bothriocephalus fuscus*. The ova were 50 u. by 32 u. in breadth. The specimen was not of Bothriocephalus latus. I am informed that dogs are often fed on fish.

No Echinococci have been found in the dogs here. The sheep frequently harbour Echinococci cysts, but as the sheep are imported and carefully kept there is little danger of the spread of this pest.

One case of Hydatid Cyst was found at a post-mortem examination of a Chinaman. It was probably imported though the man had been some years in the country.

Rats in Singapore as shown by Dr. Finlayson are often infested with cystic tumours of the liver containing immature tape-worms. These cystic tænia differ from echinococcus in the enormous development of the neck, which in some instances was 60 mm. in length. Probably these worms are *Cysticercus Fasciolata* cystic or embryonic stage of tænia crassicollis of the cat. The cysts are thick walled about $\frac{1}{2}$ inch in diameter and imbedded in the substance of the liver. The embryo contained in the cyst has the usual cephalic armature of a double row of hooklets the internal and larger are the less numerous. The total number seems to vary from 28 to 32. These circles of hooklets are situated at the apex of the conical head, and behind them are four oval suckers. The widest part of the worm is about 3 mm. from the head where they are some 1.75 mm. in breadth. Behind this point the worm slowly tapers and soon becomes thin, much flattened, and apparently consists of little but fibrous ribbon. The part behind the head is transversely wrinkled but there is no true segmentation.

In the hepatic interlobular spaces of one of these rats ova were found in large numbers. These ova measure .6 by .3 mm., and at each end have an opening somewhat like that in the ovum of a Tricocephalus. The egg coating is thick and in two layers which are closely applied to each other the outer is clear and transparent with coarse transverse marking and the inner more opaque, brown and uniform. The egg contents were shrunken and show no trace of definite structure. No other organs were sent to me. The eggs have no resemblance to those found in man by Dr. Catto in a similar position in the liver as well as in other organs in the case of infection by the Schistostoma recently described by him.

Nematodes.

Intestinal nematodes in man were not as common as in many parts of the tropics.

Those found were *Ascaris lumbricoides*, *Tricocephalus dispar*, *Oxyuris vermicularis* and *Anchylostoma duodenale*. A few Anchylostomes or traces of their presence were found in the great majority of the cases examined. These cases were Chinese and Tamils. Ova of the same parasites were found in the stools of 13 out of 21 Malay prisoners.

Though found in all races it was exceptional to find the parasites in large numbers. This is in marked contrast with most tropical countries where anchylostomes if widely distributed are also found in large numbers in a considerable proportion of the cases. This rarity of severe infections is probably to be attributed to the Chinese method of disposal of excreta. The fæces are either collected in large jars or passed into open cess pits. In either case the mass is attacked almost at once by dipterous larvæ usually of Sarcophagi which are deposited living on the fæces. The larvæ swarming in the previous dejecta also attack the fresh fæces.

Experiments were made by allowing such larvæ to feed on fæces containing various ova of intestinal parasites and these larvæ were then placed in a clean vessel and their dejecta examined. It was found that ankylostoma ova were completely destroyed in passage through the intestine of these larvæ whilst ova provided with thick shells, *i.e.*, Ascaris Lumbricoides, Tricocephalus dispar, and Distoma sinense were passed unchanged. A few larvæ were placed in glass vessels with a small quantity of fæces containing various ova in large numbers. The result of the experiments leads to similar conclusions. No anchylostoma ova or embryo were found in the mass after a few hours. The number of larvæ, their age and the relative amount of fæces are all points which affect the rate at which this total destruction of Anchylostome eggs takes place.

In the practical use either of open cess pits or of Chinese jars the number of larvæ of various ages near the surface is so great that anchylostoma ova, though in this climate they hatch under 48 hours, have little or no chance under those conditions of reaching the infective stage of free embryonic life. In the earthenware jars any larvæ that did arrive at such stage can only live for a few days in either pure or putrid fæces.

Eggs of the other parasites mentioned are not destroyed in this manner.

Tamils who pass fæces in the bush or amongst their gardens harbour the parasites in larger numbers as though no doubt larvæ are deposited on the fæces shortly after they are passed still many anchylostoma will have hatched out and escaped into the earth before the young larvæ have had time to pass the whole of the dejecta through their intestines.

Clinically cases of profound anæmia due to anchylostoma are uncommon in Malaya but do occur, and minor cases are more common. Out of 328 post-mortem examinations on Chinese the deaths due solely to this cause were only 2, but in 4 others there was reason to believe that the presence of these parasites contributed to the fatal result of the other diseases from which the patients were suffering. In the Tamils on the other hand 5 out of 32 deaths were attributed to this cause either alone or in the main.

Embryos of *Anguilula Intestinale* were found in fæces on several occasions.

In the domesticated animals Mr. FORD, the Government Veterinary Surgeon, has observed *Ascaris Marginata* in the dog, and *Ascaris Suilla* in the pig, and *Oxyuris Curvula* in the horse.

In horses *Strongylus Armatus* was found both in the sexual condition in the cæcum and in the agamous form in intestinal tumours. It is probably injurious in those positions but more so in other situations.

In a bullock and a calf *Strongylus contortus* was found in large numbers but appears to be a rare parasite.

In dogs *Tricocephalus depressiusculus*, *Uncinaria trigonocephala* are found, and in the Oesophagus or in tumours in its vicinity the *Spiroptera sanguinolenta* is not uncommon.

Strongylus micrurus so common in the lungs of cattle in the West Indies and Central Africa has not been observed here.

In Indian buffalo calves but not in adults a *Syngamus* was found in the upper part of the larynx. The worms were firmly attached to the mucous membrane. The mouth has the usual strongyloid armature opening into a buccal expanded cavity. The opening of the œsophagus is guarded by 6 teeth. The œsophagus itself is very muscular and .9 mm. in length. The genital opening of the female is situated about the junction of the anterior with the second quarter of the body. The worms were red in colour and the male firmly attached in each instance to the female. The head of the male was free. In size and characters this parasite closely resembles *Syngamus trachealis* of domesticated birds. The length of females was 6 to 8 mm. and of the male 3.5 to 5 mm.

In one calf in addition to *Strongylus contortus* an Anguillula nearly twice the length of the human *Anguillula intestinalis* was found, and in addition a second Strongylus in small numbers in the abomasum.

The *Strongylus Contortus* is readily recognised even with the naked eye by the way in which the ovaries are twisted round the alimentary canal.

The head is unarmed and terminal. Two lateral cuticular spikes pointing backwards are situated .4 mm. from the head. The œsophagus is 1.5 mm. in length, a powerful muscular tube slightly dilated just above the junction with the intestine. The anus is subterminal and the tail is sharply pointed. There are two ovarian tubes. The vagina opening is in a deep sulcus surmounted by a fold of the cuticle and subjacent tissues at a point about one-fifth of the length of the body from the tip of the tail. The females were 18 to 20 mm. in length.

The males 9 to 10 mm. in length have a bilobed caudal pouch, each lobe strengthened by 4 ribs.

The two equal spicules including the trumpet shaped expansion are only .35 mm. in length.

The position of the vulva is that described in Strongylus Contortus, and not as in the more usual bovine species Strongylus Convolutus. The worms also are larger than that species. Strongylus contortus is a dangerous worm to sheep, the allied species in the goat and cattle are also dangerous. No other cause of death was found in the calf from which this and the two other species of worms were obtained. It had rinderpest about a month before but made a good recovery. The other Strongylus, which I propose to call *Strongylus Fordii*, was not present in such large numbers.

It is larger, had not the lateral cuticular spikes near the head, and the genital spicules in the male are of extraordinary length. The genital opening of the female is near the tail and is not surmounted by a projection as in *Strongylus contortus*.

The female, 21 mm. in length, greatest breadth .5 mm. The mouth is terminal and the cuticle surrounding it is thickened so as to form a circle of small rounded projections. The œsophagus, 1.9 mm. in length, is thick muscular and ends in a slight dilation before the marked junction with the intestine. The rectum is thin walled and terminates in the anus close to the sharp pointed tail.

The ovarian tubes are double, are not twisted round the intestine as in Strongylus Contortus, and end in a long thin walled vagina in which a single row of eggs is contained. The genital opening is marked by no protecting fold and is situated .5 to .6 mm. from the tip of the tail.

The male, 19 mm. long .44 mm. broad, terminates in a bilobed caudal pouch strengthened by ribs. The spicules which are protruded between the lobes for a variable length are continued in the interior, are distinctly tubular and terminate in a trumpet-shaped expansion. They are equal, and the total length is 6.2 mm. or more than $\frac{1}{4}$ the length of the body.

In both males and females the anterior part of the body for some 1 to 1.5 mm. is contracted and the cuticle somewhat thinner than elsewhere. To this part debris is adherent, as is usual in portions of worms such as Tricocephali which are plunged into the mucous membranes.

I can find no record of Strongylus corresponding to this worm, probably it is a new species. So many members of this genus are dangerous that this worm should be regarded with grave suspicion.

The Anguillula was not present in large numbers. Only females were found. They measured 5.5 to 6 mm. in length and .03 mm. breadth, and are probably a new species, *Anguillula Bovis*.

The most important parasite of domesticated birds found was *Heterakis Maculosa* which is found in enormous numbers in the intestine of certain groups of pigeons in Kwala Lumpur. Treatment by powdered areca nut is highly successful. The mortality amongst such groups of birds untreated is great.

In monkeys various species of worms were found. In no instance did they belong to any of the species infecting man. They included species belonging to the Sclerostoma, Oesophagostoma, Ascarides, Oxyurides and Tricocephali. None of them appear to be of pathological importance.

Filaridæ.

In man the only filaria found were the embryos of Filaria Bancrofti (Filaria hosminis sanguinis nocturna). The blood of 100 patients (Chinese 75, Tamils 23, Malay 2) taken between 10 p.m. and midnight showed Filarial Embryos in 3. Of these 2 were Tamils and one Chinese.

Elephantiasis is observed from time to time but very rarely in this district. Dr. McCLOSKY informs me that the cases of elephantiasis, admitted at the District Hospital in the last 4 years is only 3, though the total admissions for all causes amount to 17,804 in that period.

One Eurasian born in this country who had lived for some years in Madras had recurrent attacks of lymphangitis, slightly enlarged groin glands, and filaria nocturna were found in his blood. As his father died some

3 years ago in this colony and had had chyluria for some time with filaria in his blood the disease in the case of his son was probably contracted in this country and not in Madras.

Culex fatigans, was shown to be here, as elsewhere, an efficient intermediate host.

Considering that the population is mainly imported from Ceylon, Southern India and China, and that in many parts of these countries Filariasis is prevalent, the scarcity of these parasites amongst the inhabitants calls for some comment.

The explanation is, however, simple, as it is only in the larger settlements that the common efficient host is to be met with, and even in such places it is not often as numerous as in most parts of the tropics.

These larger settlements are of recent date and are steadily increasing in size. Little doubt can be entertained that with the continued increase in these towns, with the overcrowding in these towns and the increasing abundant provision of suitable breeding grounds for efficient carriers as Culex fatigans, the occasional introduction of cases of filariasis will eventuate in the infection of many persons and the addition of Elephantiasis and other filarial diseases to the number of important ailments in the country. These diseases were introduced into America and the West Indies, and now in places affect up to 20 per cent. of the population, Europeans, Asiatics and Africans alike.

In the domesticated animals filaria are common. The classification of the Filaridæ is very difficult, and several of the points laid down are difficult to determine. On account of the uniformity in the simple condition of parasitic life no doubt many structures are imperfectly developed. Even the characteristics of the family, the absence of an œsophageal bulb, presence of preanal papillæ, a single or two unequal spicules in the male and two ovarian tubes in the female, are not constant even in worms which are ordinarily included in the family. The inclusion in this description of worms which in other characters and in their habits correspond to the Filaridæ is made for convenience and whilst awaiting a sound comprehensive classification of the group.

Two species of Spiroptera were found. The S. Sanguinolenta already mentioned in dogs, and *Spiroptera reticulata* in tumors from near the shoulder in bullock beef. This Spiroptera is highly exceptional in the Bovidæ, but I am assured by Mr. Ford who found the tumors, that the meat was that of a bullock. Those worms are readily recognised by the spiral ridges in the cuticle. The interlacing of these ridges and processes from them gives a peculiar reticular appearance characteristic of this worm.

In the horse the *Filaria Oculi Equi* was found on several occasions, but is not very common and seems to be rare for long periods. On one horse a few sharp-tailed sheathless filarial embryos were found in the blood. Subsequent examinations no embryo could be found and the parental forms were not discovered at a post-mortem examination.

In the Bovidæ extra-ocular filaria are fairly common and correspond to the descriptions of *Filaria lachrymalis* it does not appear to cause more than a slight conjunctivitis.

The mature female filaria measure 2 cm. and are .18 mm. in breadth. The two ovarian tubes open into a dilated vagina .25 mm. in length. The genital opening is 1.1 mm. from the head. Ova not embryos were contained in the vagina. Mouth terminate and unarmed. Junction of œsophagus

with the intestine ill defined. Anus subterminal .3 mm. from the pointed tip of the tail. No males were seen. This worm is clearly distinct and from the extra ocular filaria of horse or fowls.

In the peritoneal cavity of almost every bullock but not in the buffalo *Filaria Cervina* are found. These worms are easily distinguished from the *Filaria papillosa* found in the horse by the presence of two blunt cuticular projections near the caudal extremity and the absence of the outer perioral papillæ. They do not cause any symptoms. One of the most interesting series of filaria are those found in the aorta. They occur in all the Bovidiæ examined, but whilst the largest species of the worm is very common in the Malay buffalo it is very rare in the Siamese bullocks.

A careful study of these filaria has been made by Dr. Tuck, and the reader is referred to his account of these worms.

The division of the ovarian tubes into four is most unusual. The peculiarity of the habitat of the adult and the absence of embryos from the blood are of great interest.

The effect on the vessels is marked. Usually they are greatly thickened, especially in the fibrous coat, and the aorta is frequently dilated whilst the interior surface is roughened and covered with ridges and strands of fibrous tissue representing the places where worms have been attached.

Small aneurismal dilatations are not uncommon. In spite of these changes the animals appear to be in good health, and Mr. Ford informs me that he has not known them in any case to cause death.

In dogs, *Filaria immitis* occurs, but is rare. Dogs thrive well in the country and it is only exceptionally that these worms are found and then usually in small numbers only.

Dr. Travers informs me, however, that some 13 years ago the disease became epidemic amongst a pack of hunting dogs. Some 15 to 20 dogs died within a period of two months from the effects of this parasite.

This is of special interest as this filaria is conveyed from dog to dog *via* mosquitoes, the intermediate hosts, in the same manner as the human *Filaria Nocturna*. Under suitable conditions there is nothing to prevent a similar outbreak of *Filariasis* in man.

The important part played by animal parasites in the causation of disease amongst man and other animals of economic value is as yet not sufficiently fully recognised. The prevalence of these parasites in the Tropics is the main cause of the unhealthiness of such countries and the greatest obstacle to the development of a country.

Many parasites at first considered to be harmless or of small importance have subsequently been shown to be either dangerous in themselves or to be closely allied to species dangerous to other animals.

A thorough knowledge of these parasites and of the conditions essential for their existence and propagation is requisite for any attempts at prevention of diseases due to such causes and therefore as full information as can be obtained is the necessary preliminary to such attempts.

The constant stream of importation of men and animals harbouring parasites may at any time result in wide diffusion of disease.

Observations on some Worms found in the Aortas of Buffaloes and Bullocks.

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In the "Veterinary Record" of June 14th, 1902, there appeared a short paper on "Aortic Worms" by Mr. T. A. FORD, M.R.C.V.S., Government Veterinary Surgeon of Selangor.

Following up this interesting line of investigation, I have made a more extended study of the aortic worms. At least two different kinds are found in the aortas of buffaloes and in those of bullocks. In their several morphological and anatomical characteristics they belong to the family Filariidæ.

Previous to FORD's publication (*loc. cit.*), nothing had to my knowledge been written about these worms and the tumours found in the aortas of so many buffaloes and bullocks. I record here my own observations. The method adopted was as follows:—

Each day all the aortas of the buffaloes and bullocks killed at the local slaughter house were dissected out by the butcher and sent to the Institute for Medical Research for my examination. Each specimen was then opened with a pair of scissors along the median line of the ventral or anterior wall, because of the usual attachment of these tumours and worms to the posterior wall. The number of tumours and worms present was in each case counted, and the latter dissected out in water in order to find the frequency of males in them. This work extended from the first week in February to the first week in June, 1904.

FREQUENCY OF AORTIC WORMS AND TUMOURS IN BUFFALOES.

Altogether 93 buffaloes were examined, and the results are tabulated as follows:—

		Percentage.
No. of Aortas examined	93	——
Do. containing worms ...	67	72
Do. with scars, cords and aneurysms	21	22.6
Do. normal	5	5·4
Total number of worms in 95 aortas ...	306.	
Average for each infected aorta ...	3.5 nearly.	

It should be mentioned that one worm corresponded to each tumour, but the former was occasionally torn off during conveyance, giving the impression that there was no worm. The head could, however, always be found inside the tumour if searched for.

The principal facts shown by the above table are the large percentage (72) of vessels which contained these worms, and the small number of aortas (5·4 per cent.), which were healthy.

A certain proportion of aortas (22.6 per cent.), though not containing any living worms, presented round oval corrugated spots, fibrous in character and rather deeply sunken in. These were once tumours. When the worm dies it shrinks up, with the result that a firm, white, fibrous cord is left.

When there are several of these scars, the cords from the different tumour remnants may be intertwined. These cords are the remains of the worms, and every intermediate stage can be traced.

Often these scars had so thinned the wall of the blood vessel, that small aneurysms were formed from them and projected outwards. Naturally these small aneurysms varied in number in different aortas. They were most frequent in the case of old animals, as in these the vessel walls are stiffer and contain less elastic tissue.

Description of Host.

The Malay or Siamese buffalo is a distinct species.

Externally it differs from the Indian buffalo in two main points:—

(*i.*) The horn is evenly flattened and ends in a sharp point instead of being rounded as in the case of Indian. So that if a transverse section be taken of both, the former will be rather angular in shape and the latter irregularly elliptical.

(*ii.*) The shape of the horn is only curved slightly inwards into a semi-circle and not twisted into a short spiral, usually from within outwards, as in the Indian buffalo. Mr. Ford states that: "The water buffalo is a ruminant averaging from 600 to 800 lbs. in weight. He passes most of his time, when not at work or feeding, in shallow muddy pools called buffalo wallows. His skin is usually covered with mud—a protection against the bites of flies, of which, in this part of the world, there are numerous and large species. When clean it is of dull black and in a few animals of a dirty pink colour and is sparsely covered with long bristles."

Anatomy of the Aorta.

The Aorta of the buffalo is composed of:—

The common Aorta—the main trunk of the arterial system—which arises from the antero-superior part of the left ventricle; it passes upwards and forwards for nearly two inches and there divides into the anterior and posterior aorta.

The anterior aorta in the buffalo is very short, seldom measuring more than one inch in length. Two main branches spring from it—the left brachial and the right or brachio cephalic.

The left brachial artery supplies the left fore limb, whilst the right divides immediately into two—the right brachial proper supplying the right fore limb and the common carotid supplying the neck and head.

The posterior aorta is larger and longer than the anterior. It commences at the level of the 4th dorsal vertebra, passes upwards and backwards forming the aortic arch, and reaching the left side of the spine at the 6th or 7th dorsal vertebra. The dorsal aorta then lies in the posterior mediastinum, and after piercing the diaphragm becomes the abdominal aorta.

Description of Aortic Tumour.

An infected aorta when freshly opened from the ventral or anterior surface shows a variable number of irregularly rounded pearly tumours projecting into the interior of the vessel. Sometimes there is only one solitary tumour. Rarely there are as many as 20, but the usual number is from 2 to 5. These are confined to the posterior aorta, but in 7 out of the 67 cases recorded above these tumours occupied the anterior aorta as well.

In six of these seven cases, the number of worms in the anterior aorta was one whilst the remaining one contained three.

The distribution of worms in these seven cases was as follows :—

Worms in		Total.
Anterior Aorta.	Posterior Aorta.	
1	3	4
3	17	20
1	14	15
1	3	4
1	7	8
1	17	18
1	—	1

In the last case the only worm present was in the anterior aorta.

The tumour measures from .5 to 2 cm. across, and its surface, especially in the lower half, is of a smooth pearly lustre. The base is circular and the whole tumour is conical in shape.

From the lowermost point close to the place of attachment of the tumour to the intima springs the worm, varying in length from 8 to 30 cm., but usually 22 to 25 cm. when sexually mature. In life the worm floats about in the blood and follows the direction of the flow, *i.e.*, backwards. The few worms situated in the anterior aorta are, however, attached to the anterior part of the tumour and their bodies carried forwards by the blood stream either into the common carotid or the brachial.

These tumours are hard and somewhat fibrous to the feel but their coats are quite smooth and form a striking contrast to the rest of the intima which is often roughened.

The worm may be dissected out of one of these tumours by means of dissecting needles with cutting edges. The tissue of the tumour is carefully torn away from below upwards along the path of the hidden worm and any tough tissue encountered is cut away with fine scissors.

The contents of the tumour consist mainly of granular debris and calcareous particles. The tumour also contains the head of the female worm, and one or more males curled many times round themselves. They may easily be pulled out of their loose surroundings. When males are present the granular debris, if mixed with a drop of normal salt solution, shows a large number of free embryos.

The portion of the female hidden inside the tumour is the narrow head end. On its entrance it receives a firm fibrous sheath from the lining of the tumour which is somewhat difficult to dissect off. The size of the worm tapers gradually as it is traced forwards until at the mouth it is not more than .5 mm. in diameter. The tough sheath surrounding the worm is firmly attached to the fibrous walls of the tumour but is lost towards the head, so that this part of the worm, much narrower than the other parts, is at liberty to move about amongst the granular debris.

Once the sheath is removed the rest of the worm will come off readily. The ensheathed portion is bent on itself and usually assumes the form of a letter S.

The portion bound down by the sheath measures about 5 mm., forming a fixed collar round this part of the worm whilst the free head portion reaches a length of 20 mm. The part of the worm inside the tumour thus measures about 25 mm.

Section of Aortic Tumour.

Sections of the aorta with attached tumour both transversely and longitudinally to the points of entrance of the worm demonstrate the following points :—

The epithelium which lines the outer surface of the tumour consists of a layer of flattened cells continuous with the endothelium of the intima. Just at the angle where it actually merges into the intima this layer is much thickened, thus forming a triangular area, but the cells still maintain their flattened character.

Beneath this endothelial layer is a dense mass of cells irregularly distributed and bound together by some thin bands of fibrous tissue. The nuclei of the cells nearest the surface are deeply stained, whilst those lower down are more or less degenerate in character, and here and there a few strands of elastic fibres (stained yellow with Van Gieson) may be encountered.

Amongst this loose granular tissue the worm is often seen cut transversely. Whilst thus *in situ*, its structure may be studied with greater ease than in a specially prepared one obtained from the dissected out worm.

The tumour is separated from the middle wall of the aorta by a thin band of elastic tissue which extends from one end to the other. The minute structures of the aorta differ somewhat markedly from those of a healthy one. Instead of the long continuous bands of elastic tissue interspersed between the fibrous strands in the tunica media one meets with short bands arranged irregularly throughout, and on the whole there is less elastic tissue in the layers of the morbid aorta than in the normal one.

The point of entry of the worm, as seen in a section of the tumour cut parallel to the worm, possesses no special significance. The sheath encircling the worm is well marked as a deeply stained fibrous band, and surrounding this are the usual loose granular masses composed of living and degenerate cells.

Remote changes in the Aorta.

In 21 out of the 93 buffaloes' aortas examined scars representing tumours which had shrunken up after the death of the worms, were found. It must be noted at the same time, however, that these scars were sometimes found side by side with fresh tumours containing living worms. Hence it is evident that the formation of these tumours does not all take place at the same time, or certain less favoured ones perish earlier than the rest. These degenerated tumours are met with in all stages from the unchanged tumour with attached dead or more or less shrunken worm to a deeply indented scar from which springs a white fibrous cord representing the remains of the worm, often in many fragments, joining with other remnants in the neighbourhood to form a loose reticulated mass.

Section of an Aortic Scar.

A section from one of these scars shows irregularly serrated edges and a surface covered by a thin epithelium consisting of small flat cells continuous with the endothelium of the aorta.

The thin layer of muscle fibres in the internal coat is largely replaced by stout fibrous tissue. The tunica media and externa also contain much fibrous tissue with a corresponding scarcity of elastic fibres. No remnant of a worm has been found in the scar tissue.

Altogether the morbid aorta is thickened but there is a loss of the elastic element in the wall. This paves the way for the formation of small aneurismal scars at the site of the degenerate tumours.

These small aneurysms are formed by the excessive thinning and the diminution of elastic fibres in the walls of the aorta in these regions. Small red clots are occasionally found in these pouches, but the fibrinous layers seen in the clots of human aneurysms indicating attempts at filling up the cavity have never been met with. These aneurysms are so small in size (seldom reaching a depth or a width of more than 1.5 cm.) that they probably play very little part in the derangement of the arterial flow or lead to rupture.

Naked Eye Appearances.

The female is a round worm. The youngest specimens found were about 6 to 7 cm. in length, and when adult 25 to 30 cm. At its head end it is attached to the tumour whilst the other extremity is free and moves about in the blood stream.

The colour is white and translucent at the tapering head end (length usually 20 mm.) but lower down the many coils of the distended uterine tubes render the worm intensely opaque. The alimentary canal can be seen as a thin brown streak. The body gradually increases in thickness as the narrow head portion is left; the diameter is greatest about the middle of the worm, whence it gradually decreases in size again and ends in the tail. The posterior portion is quite transparent from the absence of the coiled tubes (10 to 12 mm.).

In the fresh state the worm is very active. When placed in water it wriggles to and fro and even when severed in many places each has the power of movement by itself, especially the tail and head. The worm has lived up to the second day when separated from the tumour. When partially dried and apparently dead the addition of water will often revive it.

Lateral Aspect.

The cuticle is firm and serrated, but there is no segmentation. This serration is quite superficial, the deeper structures showing no signs of it at all. The superficial markings extend along the whole length of the worm from the head to the tail.

Beneath the cuticle the two layers of the muscular layer may be easily differentiated under the high power.

At the mouth the longitudinal layer seems to be reflected on to the muscles of the œsophagus, thus forming an angle at their point of junction.

A little lower down, about 5 mm. from the mouth, two gland-like structures appear to be attached to the œsophagus and held in position by some transverse fibres from the circular coat. These may be the salivary glands. Towards the tail the muscular layers grow somewhat in thickness, and where the intestinal canal terminates in the anus, these muscles are continued up to the very end as a firm band.

The Digestive System.

The mouth is anterior and surrounded by an oral ring. In the living state this mouth is very retractile, coming in and out of its ring with great vigour. It is continued into the œsophagus, also an extremely retractile tube. This measures quite 7 mm. in length, and appears in the fresh specimen as a white opaque tube. In fact so retractile is it that when stained and preserved in glycerine it shrinks into a spiral tube looking wavy instead of straight. The canal itself is very narrow and appears as a slit between the thick walls.

Along its long course the œsophagus is crossed over at many places by the uterine tube, which is the only other visible tube in this part of the worm. The œsophagus in the female is a very long tube.

After about 7 mm. the œsophagus becomes suddenly dilated into the bulbous stomach which as such is continued further on as the intestine without, however, any visible differentation. The intestine is nearly straight and terminates in the anus.

The stomach and intestine are brownish-red in colour, instead of opaque like the œsophagus. This is the due to the presence of half digested blood present along its whole length. Under the microscope the contents of this part of the intestinal canal show large numbers of corpuscles which have evidently been absorbed from the buffalo's blood.

Beyond the two solitary glands opening into the œsophagus (.5 mm. from mouth; ? salivary glands) there is no evidence of any other opening into the alimentary system along its whole course.

The anus is subterminal in the female and situated about 2 to 3 mm. from the tip.

Nervous System.

At the oral ring there is a circular cord-like structure with one longitudinal branch springing from it on either side. But these two longitudinal cords cannot be traced far down, as they disappear in the meshes of the longitudinal muscles. In transverse sections, however, the two cords can be made out with tolerable accuracy lying in the midst of the longitudinal fibres. No gangliform swelling has ever been noticed.

Genital System.—Female.

The sexes are separate, and the male is smaller than the female. The dissection is a rather delicate operation especially in its upper part. A very fine pair of scissors and forceps are necessary and the whole process should be carried on in water. On looking at the upper tapering portion of the worm through the undisturbed cuticle, one finds a thin tube lying side by side with the brown alimentary canal. This is the single uterine tube, and further back are the coils of the distended ovarian tubes. These are intensely opaque from the distension with many embryos.

On splitting the cuticle this delicate ovarian system can be separated out, and the few thin bands binding it to the cuticle may easily be torn through. In the distended areas the ovaries are liable to be ruptured, making the water quite milky, but this is an unimportant accident since the most essential parts of the apparatus will have been seen.

The genitial or vaginal opening of the aortic worm of the buffalo is situated near to the head (.65 to .75 mm. from the oral aperture). It lies on the ventral surface and under exceptional circumstances can be made out as a distinct slit.

These rare occasions occur when the living embryos are seen escaping from the vagina.

Through this opening hundreds and hundreds of mature embryos with their sheaths already cast off escape. They come out in ones or twos, sometimes head first, sometimes tail foremost, and sometimes in coils. When more than one, the embryos may be seen struggling against each other to get through. During life the uterine tube may be noticed to terminate abruptly at this region but the genital opening is not obvious and there is no papilla. In the fresh state it can be recognised by:—

(*a.*) The escape of embryos.

(*b.*) A discharge soon after the escape of each embryo, consisting partly of fluid and partly of granular debris.

(*c.*) The detection of a narrow passage representing the vagina which can be made out by careful focussing through the thickness of the worm. This leads to a slightly more dilated tube containing embryos all very active and all striving to reach the outside first. The whole view altogether presents a striking picture.

As far as can be seen, although the opening at ordinary times is not evident, the cuticular muscles must be specially developed at that point so as to open automatically for the passage of the embryos.

In a successful preparation two or three of these embryos may be fixed *in situ* as they are escaping from the genital opening. This preparation can be made by running under the coverglass a saturated solution of Mercury Perchloride at the right moment, then washing with water, and clearing with glycerine. The worm is rendered more transparent now, but the various embryos are not so easy to make out as they lie inside the single uterine tube. The genital opening, however, is interesting. At the site where the embryo or embryos are on the point of emerging, there is a swollen papilla-like process projecting outwards and encircling the embryos tightly.

Picrocarmine and other basic stains bring out these points more clearly. The genital aperture leads to the vagina, a thin narrow passage merging

imperceptibly into the single uterine tube. The walls of this tube are thicker than elsewhere. The single uterine tube traverses the whole length of the tapering portion of the worm (20 mm.) as well as a portion of the body proper up to a point 40 mm. from the mouth. Thus the length of this single uterine tube is quite 40 mm. in length. The contents of this tube are mature embryos whose shells have been shed, and it is these which give such a lively appearance to this part of the living worm.

The uterine canal at this juncture swells slightly in size, the swelling measuring only 5 mm. in length. It then divides into two separate tubes, each of which again soon subdivides into two, making thus four separate tubules altogether. The distance from the bifurcation of the single tube to the point where these four tubules are formed is 20 mm. The four tubules which we may call the ovaries or ovarian tubes are much larger than the parent tube; in fact quite four times as broad. The ovarian tubes are twisted round one another in a spiral manner enclosing amongst them at places the brown coloured intestine which can easily be distinguished even through the undissected cuticle of the worm. These ovaries extend over a great length and terminate within a few mm. of the tail. There each tube ends blindly.

In the adult female worm these ovarian tubes are always engorged with ova in different stages of development. The youngest ova are formed in the most distal portion from the budding of the germinal cells of the epithelium. As these ova travel forwards they get fertilised and undergo further development. So that as we travel forwards from the tail end to the genital opening, we find these ova in various stages of development. The mere simple cells at the distal extremity become encapsuled cells further on, encapsuled young embryos still further on, and finally young wriggling free embryos with shells torn off in the single uterine tube. An instructive method of studying these various processes is to get a drop of the contents of the ovaries from different parts of the genital apparatus and examining them fresh.

The total length of each of the ovarian tubes is not easy to determine, but it cannot come approximately to less than twice the length of the worm for not only are these tubes twisted. but are at places bent on themselves so as to occupy the body cavity to greater advantage.

In fact so much pressure is exerted on the cuticle by these distended coils of the ovary, that a little rough handling is often quite sufficient to burst the cuticle and rupture one or more coils, resulting in ova and embryos escaping in large numbers.

Even submersion in a fixing fluid like weak formaline (2 per cent.) or alcohol (30 per cent.) very commonly causes the cuticle and ovarian tubes to rupture.

Transverse Section.

A transverse section of the worm about its middle shows little but the ovaries. These are so engorged with ova and embryos that every other organ is displaced to one side by them.

A better idea of the relative position of the component parts is obtained when a section of the tumour itself is cut with the worm *in situ*, i.e., towards the cephalic region.

Outside is the tough sheath surrounding the worm, next to it lies a narrow cuticular layer; beneath this is the circular muscular coat and then the longitudinal; the latter is the thicker. It is interesting to note that these layers are thicker over the dorsal and ventral than the lateral regions. No special coelomic cavity lined by a special epithelium seems to exist although there is a large open space where the alimentary tract and the four coils of the ovary lie.

The intestinal canal may be distinguished by its flattened shape and by the cubical granular epithelium evenly laid out. The uterine tube, on the other hand, presents a peculiar uneven epithelium lining the interior. This is due to the cells projecting inwards with their large nuclei (seen best under the one-twelfth oil immersion). These cells are never many, and in section usually between 6 and 8 are seen. External to this epithelium is the smooth muscle layer which is evenly distributed. Within the lateral longitudinal muscular layer two small peculiar structures looking like nerve cords are sometimes seen cut transversely.

There is no regular water-vascular system.

A section of the worm at the tapering portion close to the head reveals the œsophagus and single uterine tube, slightly thicker here than elsewhere, lying side by side, whilst the other structures diminish in size correspondingly. Towards the tail end where the ova are formed, the ovarian tubes are more or less solid in character due to the rapid proliferation of the cells of the germinal epithelium.

Ova and Embryos.

The ova and embryos are not unlike those of many other species of Filaria in their appearance.

In all the young embryos of fertilised ova, a thin capsule completely encircling the contents is present. This capsule is oval and possesses sometimes a pointed spicule at one extremity, more often one at both extremities (? micropyle). What the functions of these spicules are it is hard to understand, for when the embryos are fully developed they break through their capsules and pass out through the genital opening into the interior of the aortic tumour and live amongst the loose granular debris. Their eventual destination has not yet been traced.

The free embryos are found scattered sometimes in very large numbers, sometimes in scanty numbers inside the aortic tumour.

When living, they are extremely active and wriggle out of the genital opening after the most peculiar contortions. Once outside, they struggle hard in the surrounding media, now coiled up, now straightened, and ever restless. No special parts or organs can be detected. When fresh, the whole embryo appears as a refractile granular mass of living substances. Under the oil immersion no œsophagus or any definite structure can be seen beyond refractile granules of various size, which are not blackened by osmic acid and hence are not fat globules.

In a stained preparation obtained from some of the contents of aortic tumour in which these embryos are present, the various structures may be more closely observed.

The length of an embryo is 292 to 325 u. (.29 to 32 mm.) and breadth is 3.5 to 4 u.

Its head is somewhat knob shaped when seen from above downwards, but occasionally presents a hooked appearance when viewed laterally. Just below the head is the slightly constricted neck which is continued as the body more or less uniform in character until the tail is reached, when it tapers rapidly to a mere filament.

There is a rudiment of a mouth on the head bounded by two oval deeply stationed nuclei. No distinct structure representing an œsophagus could, however, be seen, unless we regard the rather indefinite interval between two rows of rod shaped nuclei for a short distance as one. The nuclei are arranged in an unusual manner. At the head portion very few or none are encountered. From the neck downwards for a distance equal to one-tenth of the whole length of the embryo these are rod shaped in character and are placed in the form of two parallel rows, thus making the intervening space appear as an œsophagus. This, however, is not constant, and a single row of 5 to 6 rod shaped nuclei may be seen occupying the centre of the neck. Lower down the nuclei are oval and are arranged irregularly, sometimes in twos, sometimes in threes, but their longest diameters are always parallel to the length of the worm. There are interruptions or gaps in this nuclear core where nothing but faintly stained protoplasm is seen.

Towards the tail, the nuclei are arranged in single file. The tail itself is finely drawn out and for 15 to 20 u. or so is occupied merely by protoplasm without any corresponding nuclei.

Male Aortic Worm of Buffalo.

The male aortic worm of the buffalo is found coiled up within the tumour. Unlike the female, no portion of its body is visible in the unbroken mass except occasionally, when the head may be seen projecting through the soft part of its covering. Each female is usually associated with one male within a tumour, but two or three separate males are common, and on one occasion as many as eight separate males were removed from one tumour though only one female was present.

This male worm lies loosely coiled up amongst the granular contents of the tumour, so that it is quite easy to remove it. On tearing away the loose tissue of the tumour, this is usually the first living structure seen. Once found, it can be pulled out without any difficulty. It may, however, be mentioned that not every tumour harbours a male worm, especially when the female is young or very old. In about 70 per cent. of the tumours dissected one or more males have been found. When the males are absent, no embryos are ever found inside the tumours. The male is a much smaller creature than the female. It measures from 45 to 50 mm. in length as compared with 200 to 300 mm. in the adult female, whilst the greatest width is never over .3 mm. as compared with 1.5 mm. in the female.

When freshly dissected out and placed in a dish containing normal saline solution, it coils and uncoils itself in a regular manner, but does not move about from place to place. The head and tail portions are the most active.

Alimentary Canal.

The mouth is surrounded by an oval ring. The rest of the alimentary canal differs from that in the female in that :—

The œsophagus is not so retractile, is much shorter, only about .6 mm. in length.

2. The intestine is scarcely ever brown in colour and does not contain blood.

3. The alimentary canal is straight, there being no distended coils of the testis to displace it.

4. The rectum ends in the common cloaca in conjunction with the vas deferens. The last deserves special mention.

The anus, merged into the cloaca, is subterminal and distant about .15 mm. from the extremity of the tail. Its details cannot be distinctly made out, being largely hidden away by the thick spicule and its sheath.

The muscular system is less developed in the male and the peculiar arrangement of the fibres is not so marked.

Nothing definite can be made of the excretory or nervous apparatus.

Genital System.

The genital system is less complicated than in the female. There is only one testis—a long narrow organ running parallel to the intestine. Above it reaches to about the middle of the body ; downwards it terminates in a vas deferens which differs in no wise from the testis beyond the fact that it is hollow and slightly narrower. Within the testis, large numbers of refractile cells may be seen in the living worm. These are the spermatozoa. They will be described more fully later on.

The vas deferens is continued as a stiff spicule which is very retractile. This—the anterior spicule—measures .22 mm. in length, and in the living stage may be seen to project in and out by means of the strong muscles attached to it.

Lying usually behind it, but occasionally by its side, is a shorter structure of a similar shape. This is the posterior spicule (sheath of the penis), and its length reaches .12 mm. This latter spicule is apparently not connected with the vas deferens. It is also moveable but not so active as the anterior spicule (penis proper) and can move independently.

The anterior spicule is a trumpet shaped organ. Where it is continuous with the vas deferens it is irregularly funnel shaped, the diameter being just under .03 mm. (30 u.). As it proceeds outwards, it tapers gradually until it finally ends in a slightly bulbous projection and then a sharply defined filament. The cuticle round the point of emergence of the two spicules is raised forming a prominent ring.

Two smaller papillæ may be seen lying in front of the opening. One is situated just anterior to the ring, and the other—a more easily detected one—30 u. or .30 mm. still anterior to this. There are, besides the above, one or more post-anal papillæ, but these cannot always be detected.

The hinder portion of the male worm is curved on its ventral surface, along which a distinct grove may be seen running longitudinally in the centre, to admit of the passage of the two spicules.

It will be seen that the arrangement of the genital organs in the male and female worms is best adapted amidst their surroundings for their several functions. The openings of both are situated inside the aortic tumour, that of the female being in the constricted portion close to the mouth, and that of the male being at the posterior extremity but well within the reach of the

female. Copulation takes place inside the tumour and the embryos produced are also discharged into it to be distributed later on to some hitherto unknown part.

Spermatozoa.

The sperm cells produced by the testis are oval, spindle shaped, or cross shaped in appearance. Their largest diameter is 10 to 12 u. Each possesses an intensely refractile nucleus surrounded by granular protoplasm. These cells may change their shape from one form to the other, but no independent movement has been seen. They are formed in the testis, and when mature pass down the straight vas deferens to be ejected through the narrow aperture in the anterior spicule. When seen under the microscope during the ejection of these cells, they are noticed to come out in strings, being attached to one another by means of some sticky substance so that they often appear as a bunch of grapes hanging on to the ventral surface of the tail.

When stained, these sperm cells show a deeply coloured nucleus situated usually in the centre and occupying a large part of the cell.

When in groups, these cells may each take a pyramidal form, being united together by delicate threads, the whole picture looking indeed like a bunch of grapes. No cilia or appendages of any sort have been seen.

Other kinds of Tumours in the Buffalo's Aorta.

Another form of tumour—the round blind tumour common in bullocks—is on rare occasions found in buffaloes. Out of 93 buffaloes' aortas examined, in one solitary case this condition was found. In this instance, three round blind tumours were scattered over the aorta, one large and two small. A female of the worm to be presently described was found in the larger tumour but no male.

Aortic Worms of Bullocks.

A totally different species is found in the bullock. The tumour instead of being much raised and irregular is flattened and rounded in shape; it is quite blind as far as the outside appearance is concerned. No large suspended worm emerges from it; and the female worm when dissected out is of a yellowish colour. It is imbedded in a dense stroma of fibrous tissue and moistened with thickish yellow liquid.

Like the buffalo, two main kinds of bullock are met with in the Malay Peninsula, namely, the Indian and the Siamese, though cross breeds are not uncommon. The Indian bullock is a better developed and finer looking animal, with long straight rounded horns standing almost parallel to one another. The Siamese or native bullock, on the other hand, is a smaller beast with short, rather curved, rounded horns pointing towards each other at the free ends. The Indian bullock weighs from 400 to 500 lbs.; the Siamese slightly less.

In addition, the Indian cow is the main source of the local milk supply, whereas the Siamese cow provides little or none.

Both varieties live much in the same way, but besides grass the Indian bullock, which is more expensive, gets a liberal supply of broken rice boiled down to the consistence of gruel.

Unlike the buffalo the bullock is not fond of shallow mud pools or dirty river banks; in fact it has to be washed regularly by the keeper, and hence the conditions under which the buffalo and bullock live differ widely. At the local slaughter house, imported Siamese and native bullocks principally are killed. The Indian ones are too expensive, but the few aortas of the latter that have been examined show no deviation from the usual rule as regards the frequency of worms within them.

The anatomy of the bullock's aorta differs in that it is smaller in size, the walls are not so thick, and there is less abundance of tough elastic tissue.

The distribution of the various branches of the thoraic aorta is just the same as in the buffalo *(see description above)*. On opening an infected aorta one usually finds round blind projections with no trace of the long opaque freely swinging worms. A more careful scrutiny, however, brings to light yellowish wavy lines or serpiginous tracks running along the length of the aorta. The tumour is smooth and shiny, yellowish white in colour like that of the rest of the aorta, and measures from 5 to 15 mm. in diameter. No trace of any worm can be noted immediately around its neighhourhood, but a few millimeters away the yellow wavy serpiginous tracts described above are always seen running down the length of the aorta for a variable distance. Some do not proceed straight but are bent at an angle, whilst portions of the same may even lie almost transversely. In fact so very convoluted are these wormy tracts that when present in large numbers the whole aorta may feel much beaded to the touch.

Occasionally the tumours are shrunken up, leaving a non-projecting surface, but the yellow wavy worms lying as they do immediately beneath the intima are quite distinct.

Even when these round blind tumours and serpiginous tracts are not present, round white scars may often be seen scattered over the intima of the aorta.

The proportion of smooth healthy aortas in the bullock is greater than the corresponding ones in the buffalo, as the following table shows:—

		Percentage.
No. of Bullock's aortas examined	155	—
,, ,, with Tumours	39	25.2
,, ,, Serpiginous tracts	25	16.1
,, ,, Scars and wrinklings	32	20.6
,, ,, of healthy one	59	38.1

Total number of tumours in 155 aortas, 157.
Average for each infected aorta 1.6.

Round Blind Tumour.

The round blind tumour was found in about a quarter of aortas examined.

To demonstrate the contents is not a simple matter of dissection, as the tumour has to be torn away piecemeal.

At a depth varying from .75 to 1.25 mm. from the surface a softer layer is encountered. This lines a small cavity consisting of loose tissue bathed in a minute amount of yellowish fluid. Inside this liquid the head of the female worm is usually seen. It may be more or less easily traced out as a yellowish structure for 5 to 7 mm. After that more tearing of the surrounding dense tissue has to be done in order to follow out its course. The firm adherence of the worm to the various layers of the vessel wall and its exceedingly wavy course make it impossible for one to dissect it out whole, so that at 20 or 30 mm. from its mouth the worm is usually torn off and the full length cannot be fully ascertained. On thing is, however, certain, and that is the fact that the worm whose head portion is enclosed within the round blind tumour is continuous with the yellow serpiginous tract running along the aorta. It is almost always at the beginning of this wavy line that the worm is torn off.

Although the majority of round blind tumours are situated in the interior of the vessel it occasionally happens that a large round stiff projection is seen on the external coat of the aorta. When dissected this external tumour proves to be of the same structure as the smooth tumour found inside. The same yellow fluid and yellow worm are harboured inside it.

It should, however, be mentioned that in addition to the yellow female worm, the male element also exists in certain tumours alongside of it. The presence of the latter is not so frequent in bullocks as in buffaloes and it is harder than even the female to isolate from the surrounding fibrous mass. Microscopically the male worm is thinner and more delicate; its colour is white and opaque instead of yellow.

The usual rule is for one male to be harboured alongside a female, but on rare occasions two males may be found inside one tumour. More frequent than not, out of the serpiginous tracts parts of both male and female worms may be extracted wound round one another.

The yellow liquid contains granular debris and broken down tissue with a variable number of ova and embryos, some free, some still encapsuled. The free ones are usually very active, and present in the fresh state no marked features different in any way from those found in buffalo tumours.

Other kinds of Tumours in the Bullock's Aorta.

Besides the round blind tumours two other kinds have been noted in the bullock. One of these takes the form of a short blunt prolongation downwards from the centre of a smooth tumour in the aorta. This probably represents the remains of a worm of the same species as that commonly found in the buffalo. A dissection of its contents confirms this opinion, for within the stump may be found the calcified remains of an old worm. Five of these peculiarly shaped tumours have been met with altogether.

Besides the above, one exceedingly interesting tumour in the form of a papilloma has been found. This papilloma is irregularly shaped, being more bulky below than above, and is attached to the aorta by a short stoutish stem springing from a swelling lying on the aorta. The projection and stem are no doubt the remains of the pearly tumour and worm described above (buffalo's) whilst the reddish brown papilloma is no more than a large clot of blood which has been formed gradually on the stem.

A section of this pseudo-papilloma reveals an irregularly formed fibrinous structure in the meshes of which a few small blood vessels may be seen. The tumour is covered by no specially developed epithelium, a single but interrupted row of flattened cells more or less representing it.

In addition to the badly stained fibrinous stroma, there are present a few small rather vascular islands of deeply stained cells scattered in the centre. These are no doubt connective tissue cells which are not yet completely organised.

No worms or embryos can be noticed anywhere inside this tumour.

Scars and Wrinklings of the Aorta.

Although the percentage of healthy as compared to morbid conditions of the bullock's aorta is great (being 38.1), there are often met with old scars and wrinklings of the vessel representing tumours and serpiginous tracts of worms which have "shrivelled up." These occurred in quite 22.6 per cent. of the cases examined. They present no special points of interest beyond the fact that the scars are only slightly depressed and are usually white and fibrous.

Lastly the large long suspending worms so common in the buffalo were present in two cases out of 155 bullocks' aortas examined. In the first case one tumour was present; in the second three tumours and worms. Being so rare no attempt was made at dissecting the latter, which was preserved for museum purposes, but a search for a male worm and embryos in the first case gave negative results. It was not possible to trace the history of the two bullocks which possessed the buffalo worms within them.

The Female Worm in Bullock's Aorta.

Its total length has never been measured as it is impossible to dissect it out completely from the dense tissue of the aorta in which it is closely enveloped. Its width is nearly the same throughout, being not much greater in the body than at the head end. The following table gives a comparison of the male and female worms as found in the buffalo and bullock.

Buffalo's Worm.		Bullock's Worm.	
Length.	*Breadth.*	*Length.*	*Breadth.*
Female 200 to 300 mm.	Head .29 to .30 mm. Body 1.25 to 1.5 mm.	Over 60 mm.	Head .25 to .27 mm. Body .350 mm.
Male 45 to 50 mm.	Head .32 mm. Body .34 mm.	42 to 45 mm.	Head .116 mm. Body .146 mm. also in another specimen Head .075 mm. Body .175 mm.

The head of this worm is situated in a minute pool of yellowish viscid liquid, in which embryos, if any, may be found. It is yellowish in colour, and since the whole body is firmly bound down with the exception of the first few millimeters at the head end, its movements are naturally confined to this part and they are withal slow.

Lower down where the serpiginous tracts are seen, its body is much bent many times on itself and consequently distorted, the whole arrangement producing the appearance of those beaded wavy lines one notices from the interior of the aorta.

So far the whole length of the worm has not been traced out on account of the firmness with which it is bound down to the adjoining structure. Hence I have not been able to find the tail end or the exit of the alimentary canal.

Digestive System.

The mouth is not surmounted by any obvious structure. In the fresh state it is very active, moving along with the œsophagus both from before backwards and from side to side. The worm is narrowest in this part of its body.

The œsophagus extending from the mouth to the stomach is a narrow structure and measures .58 to .62 mm. in length. It is thin-walled and presents a striking contrast to the thick muscular stomach and intestine following it. No glands are seen opening into it. There is only a very faint differentiation between the stomach and intestine, so that it is not quite evident at which point the stomach is merged into the intestine. The intestine follows the wavy course of the worm along its whole length as far as has been traced. There is no variation in the size of the gut all along its course.

Generative System.

It differs very markedly from the one in the buffalo in possessing *only two ovaries* or ovarian tubes instead of four.

The genital aperture is situated on one side of the body about .90 to .95 mm. from the mouth. In the first state it is not marked by any special papilla, but the occasional escape of ova and embryos indicates its exact position. In a preserved glycerine specimen the uterus with its contents may be seen to terminate here.

The uterus is continued for 10 to 15 mm. before two ovarian tubes open into it. These are of the same diameter throughout, and are not distended like those met with in the buffalo. They are slender but may contain large numbers of ova and embryos, both encapsuled and free.

These two tubes, if traced towards the distal end, become a solid mass of cells. The appearance in transverse section will be described later on.

The ova are not very different from those found in the buffalo. They are round or oval, measuring from 10 by 15 u. in the youngest stage to 20 by 40 u. in the fully developed but still encapsuled embryo. Here also we notice the spicules at one or both ends of the capsule surrounding a hyaline protoplasm with very granular embryo.

As in the buffalo's worm, so in this one also the different stages of the ova may be traced as one proceeds from the distal end of the ovary, through the narrow ovarian tubes to the uterus. From single cells one comes to simple cells showing nuclear division, and past this to the same with their capsules thickened. Next, rudiments of the future embryos are encountered until, near the single uterine tube, one finally meets with the free embryos which have broken from their capsules and are wriggling about in an active manner.

Finally these free embryos escape from the body through the genital pore.

Transverse Section of Female Worm.

When the worm is cut transversely *in situ* in the wall of the bullock's aorta it is seen to invade principally the outer part of the middle coat. Here one notices that it is cut in many places, each being enclosed in a bed of fibrous tissue without, however, any special defining layer.

The worm is much shrunken up and distorted, but this is due to the effect of alcohol, etc.

Outside is the cuticle, whilst next to it lies the two muscular layers—circular and longitudinal. Both, especially the latter, are poorly developed.

Attached by loose tissue to this body wall is the alimentary canal also much flattened and distorted by the distended tubes of the ovary, which, as I have said above, are two in number. The structure of these tubes, as they are traced from the true ovary downwards (*i.e.*, mouthwards) is interesting. At the upper end is the somewhat thick muscular wall lined by a rather dense irregularly projecting epithelium (*see figure*).

The ova when mature are, as it were, budded off this epithelial lining, retaining of course half the nuclei, and appear as clusters of two or more oval cells at places. That part of the epithelium from which the ova have been detached is shorter than the rest, and hence the peculiar zig-zag arrangement of the cells. Lower down the ovarian tube changes somewhat in character, the muscular wall being now thicker and the epithelium more even. Groups of ova may also be seen in the lumen.

Lastly, when fertilization takes place, these ova undergo the usual changes, so that embryos in all their various stages may be met with in the two uterine tubes, still enclosed in their respective capsules. By the time they reach the single uterine canal, the capsules will have been left behind, and we encounter the active wriggling embryos finding their way out of the body through the small genital opening.

No other special structures could be distinguished in a transverse section.

The Male Worm.

The male worm is found in less than half the tumours dissected and hence is rarer than the corresponding one in the buffalo. Besides that, it is also harder to dissect out, being smaller and more firmly adherent to the tissues in which it is hidden.

This worm is a white thread-like structure, and when found is seen to be closely wound up with the female of the same tumour. Its white

opaque colour contrasts well with the larger yellow coloured female worm Owing to its shorter length the male worm can be more easily traced from the head to the tail.

When thus completely dissected out it is found to measure from 42 to 45 mm. in length. The maximum width in the centre of the body is only .146 mm. whilst at the head it reaches not more than .116 mm. (In another case head .075, body .175 mm.).

Like other male Nematodes the tail is curled ventrally round its spicule, which though small can just be seen with the naked eye as a white speck.

Alimentary Canal.

The alimentary canal of the male worm presents a striking contrast to that of the female and to that of the male found in the buffalo's tumour, in the possession of a very muscular and easily recognised stomach. The œsophagus is .511 mm. in length, *i.e.*, a little shorter than in the female (.584 mm.). It is suddenly expanded into a thick muscular intensely white stomach which runs a straight course and measures 2.2 to 2.5 mm. in length.

After this the alimentary canal narrows again into the intestine, which is a little bigger than the œsophagus. The intestine is continued along the length of the worm and finally ends in the cloaca.

No definite glands may be seen opening into any part of the digestive tract.

Genital System.

There is only one Testis, elongated in shape and lighter in colour than the gut lying by its side. Above it reaches a variable distance, but below it is continued into the single vas deferens which finally terminates by opening into the common cloaca. At the cloaca which is situated .15 to .20 mm. from the tail extremity, one notes two spicules—an anterior and longer one (? penis) and a shorter and posterior one (? sheath). The anterior spicule, which is continuous with the vas deferens through the funnel shaped opening, measures .262 mm. in length, whilst the shorter or posterior spicule is .116 mm. long.

The general arrangement and structure of these spicules are much the same as in the corresponding worm of the buffalo and therefore need not be repeated here. To the two spicules are attached powerful muscles for their free movements.

The interesting part lies in the papillæ, of which two pairs are anterior to the cloaca (preanal) and at least six pairs are posterior.

These papillæ are much larger and more distinct than in the buffalo's worm, where only two can be faintly made out. The two preanal ones are particularly large, the first lying 18 u. anterior to and the second just in front of the cloaca.

The second and third pairs and the third and fourth are each 37 u. distant from one another, whilst the last three pairs are quite close together. They diminish in size as we go backwards.

The position and relation of these various papillæ present a more striking picture when seen from the ventral surface than when viewed

sideways. When viewed under a high power the general epithelium covering the body is seen to be thrown over these sensitive structures as a distinct well-marked line.

The groove lying between these two rows of papillæ is wide.

Spermatozoa.

The spermatozoa as obtained from the testis of a bullock's worm are round granular very refractile bodies, and in the fresh state cannot be easily distinguished from ova. They of course escape from the cloaca through the penis, and are often glued together in clumps and suspended from the opening.

In stained specimens they shrink up greatly and appear more or less pyramidal in shape, being attached to one another by delicate fibrinous matter, the whole picture thus assuming a grapelike form. The nuclei are deeply stained whilst the protoplasm presents no special characteristics.

The points of difference and resemblance in the two species of worms are seen in the subjoined table :—

Females.

	Buffalo Worm.	Bullock Worm.
Length	Average 220 to 250 mm. ..	Over 60 mm.; never completely dissected out.
Greatest Breadth ..	1.25 to 1.5 mm.	.35 mm.
Diameter of Head ..	.29 to .30 mm.	.25 to .27 mm.
Character of cephalic end.	Tapering and much smaller than body. Tapering portion 25 mm. Neck surrounded by a collar.	Not much narrower than rest of body. No distinct line of demarcation from rest of body.
Distance of genital pore from oral opening.	.65 to .75 mm.	.90 to .95 mm.
Diameter at point of genital pore.	.33 to .37 mm.	.20 to .29 mm.
Distance of anus from tail.	2 to 3 mm.	?
Cuticular thickening at tip of tail	Not specially thickened ..	?
Mouth	Surrounded by an oral ring.	No definite oral ring detected.
Oesophagus	Narrow, retractile tube, 7 mm. long. Diameter Oesophagus .116 mm Diameter Stomach .233 mm.	Narrow retractile tube .58 to .62 mm. long.

Females.—cont.

Stomach	Thick muscular wall. Marked bulbous expansion from œsophagus. No definite line of demarcation from intestine.	Thick muscular wall. Expansion from œsophagus. No definite line of demarcation from intestine.
Intestine	No division into rectum. Ends in anus (subterminal).	Is continued to anus. (? subterminal).
Length of uterus ..	40 mm. Divides first into two tubes, each of which again subdivides into two.	10 to 15 mm. Divides into two tubes only.
Ovarian tubes	Four altogether. Bulbous and very opaque and distended.	Two only. Not bulbous or much distended.
Character of ova ..	Oval cells surrounded by thick capsule usually. Capsule possesses two pointed spicules at extremities, sometimes one.	Similar to that in buffalo.
Character of embryos..	Very active. Length .29 to .32 mm. Breadth at head 3.5 to 4 u.	Very active. Similar to that in buffalo.

Males.

Length	45 to 50 mm. long	42 to 45 mm. long.
Greatest Breadth ..	.34 mm.	.145 to .175 mm.
Diameter of Head ..	.32 mm.	.075 to .116 mm.
Character of Cephalic end.	Nothing marked. No differentiation from rest of body.	Nothing marked.
Distance of cloaca from tail	.102 mm.	.210 mm. (over twice distance that in buffalo).
Cuticular thickening at tip of tail.	Not marked	Marked (over 5 times usual thickness).
Spicules	Two { Anterior long .22 mm. Posterior short .12 mm.	Two { Anterior long .262 mm. Posterior short .116mm
Papillæ	Two pairs preanal. Very small, posterior one being more evident; postanal doubtful.	Two pairs preanal large and distinct. At least six pairs postanal, also distinct.
Mouth	Oral ring usually in living specimen.	No oral ring detected.
Oesophagus	Narrow tube .584 mm. long.	Narrow tube .511 mm. long.
Stomach	Expanded tube	Expanded tube, very opaque 2.2 to 2.5 mm. long.
Intestine	No differentiation from stomach.	No differentiation from stomach.
Character of Spermatozoa.	Refractile bodies, smaller in size than ova. When fresh oval or spindle shaped. When stained usually pyramidal. Attached by delicate threads to one another.	Similar.

Other Diseases.

Results of Post-Mortem Examinations.—The bodies were obtained from the District Hospital, Kwala Lumpur, from April 1st, 1903, to August 15th, 1904. During the period 805 Chinese and 126 Tamils and Bengalese died. Of these the bodies of 328 Chinese and 32 Tamils were examined. On account of religious and racial prejudices no autopsies can be obtained on Malays whether from Malay proper or the islands in the Malay Archipelago.

It is to be, therefore, noted that these examinations show the diseases present and the causes of death in imported races only. How far the diseases also were imported or acquired in the country is in some cases uncertain, but as most of the cases were of persons who had been resident in various parts of the Federated Malay States for some years, all the acute diseases must have been acquired in this country.

Generally speaking, only a few of the examinations made were of selected cases, but there were exceptions which will be considered separately. The causes of death were, in many instances, complicated. Dysentery in particular appears to be a terminal disease in many chronic illnesses, just as diarrhœa in children is often the last stage of any wasting disease in temperate climates.

Of the Chinese cases examined, 328 in all, 65 had Dysentery, 64 Tuberculosis, 19 Acute Malaria with parasites present, 17 Pneumonia, 5 Typhoid, in 34 probably the chief cause of death was Beri-beri. There were 17 deaths from Sepsis, 14 from Cirrhosis of the Liver, 10 from Malignant Disease, and two from uncomplicated Anchylostomasis.

Of the 32 Tamils examined, 17 died of dysentery, 5 from Pneumonia and Anchylostomasis respectively, and 4 from Tuberculosis.

Subjoined in tabular form is the percentage of each of the more common diseases in the two races.

Percentage of Deaths.

——	Chinese.	Tamils.
Dysentery	22	51
Tuberculosis	19.5	12
Beri-Beri	10.3	...
Malaria	6.6	...
Pneumonia	6	15
Achylostomasis	.6	15
Malignant Disease	3.3	...
Cirrhosis of Liver	4.6	3
Sepsis	5.6	...
Bright's Disease	3	...
Typhoid	2	...

It will be seen that there is a marked difference in the incidence of the diseases in the two races, and that whilst Tamils suffer more from Dysentery

and Pneumonia, they are here not so often victims of Beri-Beri. The Chinese suffer less from Dysentery and Pneumonia but more from Tuberculosis. A similar difference is observed amongst Negro and Indians (mainly from Calcutta) in British Guiana. Tuberculosis is the pulmonary disease of the Negro, and he rarely gets Pneumonia, whilst the Indians, the Aboriginals and the Europeans are rather less subject to Tuberculosis but much more so to Pneumonia.

The prevalence of fatal Malaria amongst the Chinese is noteworthy, as the Tamils are equally exposed to infection, and are by no means exempt from mild attacks. This susceptibility to Malaria in the Chinese is probably due to the smaller amount of Malaria in China than in the Madras Presidency or Ceylon, so that the Chinese have not suffered the early and repeated infections necessary to induce immunity. Two-thirds of the fatal cases were in persons who had been in the country four years or less.

The fatality amongst Chinese when introduced into badly Malarial countries, such as West Africa, is well known, and the same occurred with Chinese imported into British Guiana. Fortunately this disease can be controlled as results here have shown, but without serious and persistent efforts to reduce the amount any natural increase in the Chinese population outside the towns cannot be anticipated.

The occurrence and causation of Malaria in these States has been already considered.

Tuberculosis.

Tuberculosis is now one of the most important diseases in the country, and according to all the evidence seems to have become much more prevalent during the last few years.

As a cause of death, judging from these returns, it ranks second only to dysentery. The medical history of other tropical countries has shown that this is a usual sequence of the imperfect adoption of European methods of life. The increased cost of land results in overcrowding. The small rooms and houses built in European style are much more expensive than native houses. They can only be remuneratively leased to persons drawing $10 to $15 a month usual wages if overcrowded. In such houses air is usually admitted in comparatively few places and so a draught is produced.

In the tropics, particularly in sleeping persons, the skin is very susceptible to slight changes in temperature, such as those produced by a draught, so that for the sake of comfort and to ensure an equable temperature such ventilating holes are frequently stopped up by the inmates of the house and the ventilation reduced to a minimum.

The dry cement or wooden floors are rarely more than brushed and never disinfected. Expectoration is indulged in freely.

Under these circumstances Tuberculosis introduced into a house, workshop, gambling room, theatre or temple, has every chance of spreading. The increase in the towns and, at present, the inefficiency of such regulations against overcrowding, etc., as exist, suffice to explain the large percentage of Tuberculosis now present, and to give serious grounds for fear that this disease will assume more serious proportions and affect the other races here resident who now suffer to a smaller extent.

In the great majority of the cases the disease has been acquired in the Federated Malay States. Of 37 in which the length of residence is recorded,

in none had the patients been less than 2 years in this country. In 9 they had been from 3 to 5 years, in 11 from 6 to 10, and in 10 over 10 years.

The increase of Tuberculosis in other tropical countries is important in this connection.

There is evidence that Tuberculosis was very rare in Demerara in the early part of last century. In 1842 BLAIR states that cases were more numerous than usual, but that of the 17 cases in the Georgetown Hospital not one was a native of the colony.

From 1842 to 1848 there were 86 deaths from Phthisis out of 2,268, or 3.7 per cent.

Now between 25 and 30 per cent. of the deaths, and a larger proportion if infantile deaths are excluded, are from Tuberculosis, and the proportion amongst the natives is as high as in imported races.

Distribution.—Evidence of tubercle was present in 70 cases. In some it was either cured or in an early stage and not sufficiently extensive to be the cause of death. In 5 there were calcareous nodules at one or both apices with much puckering of the apical portion of the lobe and some increased fibrosis. In two more there were similar calcareous or cretaceous nodules with surrounding recent miliary tubercle, and in one of these there were also tubercular ulcers in the small intestine. This tendency to cure in cases of Tuberculosis in the Chinese is promising. It is in marked contrast to the absence of any such tendency in Negroes and in most primitive races. In four a small portion of the superior lobe on one side only was involved, and in one of these there was a small recent cavity. In the remaining 60 cases Tuberculosis was advanced. Both lungs were involved in 49; one lung only in 21; so that in all the lungs were involved. In addition in 3 the larynx was extensively involved; in one the tonsils; the stomach in 2; the small intestines in 40; and the large intestine also in 21. When the large intestine was involved, superficial or deep non-tubercular ulceration was often present as well. In some cases where there were no tubercular ulcers, ulcers of other nature were present.

This extensive implication of the large intestines in cases of tubercle is one of the features of tropical tuberculosis. It is to be noted that in one case it was associated with almost healed pulmonary tuberculosis, and that in extent it is not related to the amount of pulmonary tuberculosis, that it is not usually associated with tuberculosis of the mesenteric glands and with a general tuberculosis though they may be present together. The probable source of the intestinal tuberculosis is auto-infection by swallowing sputum. The absence of tuberculosis from cattle renders it improbable that here it is derived from external sources.

General tuberculosis involving several organs of the body was fairly common. In 16 the spleen was involved, in 7 the liver, and in 6 the kidneys. In some of the instances no visible tubercles could be seen, but scrapings showed the presence of tubercle bacilli. In 5 there was tubercular peritonitis, and in one other case extensive old peritoneal adhesions. There were two cases of Tubercular Meningitis, and one of a tubercular mass in the brain.

Of associated diseases which probably had no connection there were two cases in which death was due to Cerebral Hæmorrhage, one in which it was certainly due to Beri-beri, one advanced Cirrhosis of the Liver, and one Dysentery and Hepatic Abscess. Of other associated diseases, in view of the recurrence of the often disproved statements of an antagonism between tuberculosis and malaria, it may be noted that parasites of Malaria were found in one case of healed Phthisis, in one of early pulmonary tuberculosis, and in two of fairly advanced tuberculosis. In several other cases recent Malaria pigment was present in the organs.

As regards occupation, such a large proportion of the persons who attend the hospital are or have been mining coolies, that these naturally form the large proportion of the patients with tuberculosis. Other occupations represented were ricksha pullers, shopkeepers, mechanics, and rarely domestic servants.

In two cases there was marked Anthracosis probably from charcoal burning.

Age.—Of 65 in which it could be approximately obtained there were 35 of 25 years of age or under, and 30 over 35 and 15 of these were over 50. As half the deaths are under 35 the incidences of this disease in old age is rather heavier than in temperate climates for advancing years, but not more so than is usual in the Tropics.

In the lower animals in the state of nature Tuberculosis is apparently unknown here. In confinement monkeys, even in well ventilated houses and when kept clean, frequently acquire it. In all cases seen the lungs were affected either alone or more commonly associated with general tuberculosis, but showing the oldest lesions in the lungs. In one case there was a definite tubercular nodule in the substance of the brain.

No tubercles were found either in imported or native cattle slaughtered or dying from Rinderpest and I am informed by the Government Veterinary Surgeon that he has not seen any cases. This is in marked contrast to British Guiana, where of animals slaughtered for food a considerable proportion are tubercular.

With the increase in Tuberculosis in man the development and spread of this disease amongst the cattle may be anticipated, as recent evidence is all in favour of the occasional communicability of Tuberculosis from man to cattle and *vice versâ*.

Dysentery.

Dysentery is the direct cause of over 40 per cent. of the deaths in the hospital, and is a contributory cause of death in a considerably larger proportion of cases.

In Tuberculosis with or without tubercular disease of the intestine it is not uncommon, and superficial ulceration, hardly to be called true dysentery, is present in many of the chronic diseases.

Of the various types of dysentery the most clearly separated is the so-called Amœbic Dysentery when it occurs uncomplicated. Unfortunately mixed cases or cases not corresponding to the type in which Amœbæ are invariably found are not uncommon. The lesions which may be considered

as typical and in which the Amœbæ are always to be found are limited to the large intestine which is usually involved in its whole extent but with more advanced or extensive lesions in the cæcum and sometimes in the sigmoid flexure.

The general mucous membrane is little affected, but the ulcers are deep and have a yellow adherent slough attached and a surrounding intensely injected edge. The ulcers in the transverse colon are discrete and vary in size from little more than a pin point to one inch in diameter, and are usually in various stages. In the cæcum and sigmoid flexure several of these ulcers often coalesce, so that in these parts a large shaggy adherent sloughy surface is presented. The pus from these ulcers or sloughs is distinctly mucoid. The amœbæ are found in this pus and in the sloughs, but most abundantly in scrapings from the floor of the abscess.

Mixed cases occur in which the intervening mucous membrane is also ulcerated or intensely congested. Tubercular ulcers in cases of tuberculosis may also be met with in conjunction with this Amœbic form of dysentery.

In other cases in which Amœbæ may or may not be found scars of old ulcers, healing ulcers and submucous abscesses in which the mucosa is undermined and more or less extensive collections of pus communicating with the lumen of the intestine by a mere pin point occur. This pus usually, but by no means invariably, is free from Amœbæ. Balantidium coli is sometimes met with in pus from such situations.

Hepatic abscesses were found in 1 per cent. of the Chinese examined. This proportion is about the same as in British Guiana. In each case ulceration of the colon, usually markedly of the Amœbic type, was present, and in all cases Amœbæ were found both in the liver abscess and in the intestinal ulcers or their discharges.

Another marked type of dysentery is the so-called diphtheritic form. In the pure cases of this type the disease is not limited to the large intestine but a variable length of the ileum and rarely also of the jejunum is involved.

The lesions in the small intestine may simply be extreme congestion most marked at the summits of the rugæ. More commonly in the lower part of the ileum there is a granular adherent superficial slough firmly adherent to the summits of the rugæ. This condition may extend up to the jejunum, but is always most marked in the last few inches of the ileum where the superficial slough may completely cover the mucous membrane. Peyers patches and the solitary glands are not swollen or specially involved.

In the cæcum the congestion is intense, the slough is deeper, and on forcible removal leaves an ulcerated surface. The whole extent of the large intestine is usually involved, but towards the rectum at the time of death there may be ulceration and little of the sloughs are left. Nine of the cases were of this type uncomplicated by other lesions.

In a typical case with these lesions Amœbæ are not found, and in most of the mixed cases in which this form of dysentery can still be recognised Amœbæ are absent, but the two types Amœbic and Diptheritic are occasionally present together.

It is strictly speaking an Entero-Colitis, and though the lesions in the majority of cases are most marked in the cæcum and large intestines in occasional rare cases the main seat of disease is in the lower part of the ileum.

A large proportion of cases of dysentery cannot be assigned to any definite type. Ulcers irregular in size, in depth, in character of surface or edges may be scattered thickly or sparsely over a varying extent of the large intestine. In such cases the actual ulceration and secondary ulcerations appear to disguise the type.

Tubercular ulcers and typhoid ulceration of the large intestine are commoner relatively in the tropics than in temperate climates, but present no difficulty in diagnosis and should cause no confusion.

The Amœbæ Coli has, in my opinion, a strong position as the factor in a large class of dysenteric lesions. The Balantidium Coli may play a part in the causation of certain other forms. In the remainder in the majority of cases no animal parasites are to be found. The bacteriology of the large intestine and its contents naturally has attracted much attention. The number of organisms found either in the contents of the intestines on scraping the ulcers or in the sloughs is large, and many of them are either commonly or rarely found in normal intestines but are present both more constantly and in larger numbers in cases of dysentery.

Amongst these organisms B. pyocyaneous is perhaps the most important. It is not a very rare bacillus in normal stools but appears to be present in the majority of cases of dysentery examined here. It is found not only in the contents of the intestines and in the sloughs, but in the depths of the ulcers and in the deep scrapings of the mucous membrane occasionally in the mesenteric glands and rarely in the spleen.

This organism has been credited with the causation of certain epidemics of dysentery. (Hewlett's *Manual of Bacteriology*, p. 439.) The varying lesions found associated with this organism, and the absence of any lesion or symptom of disease in other cases where the organism is present, render it improbable that it is the cause of the disease, but the increased numbers and the known pathogenicity of the organism in lower animals and its occurrence in tissues are arguments for considering it of importance as a secondary cause of some of the lesions or complications. The organism isolated from dysentery cases is indistinguishable from that isolated from healthy intestines or from natural sources, and does not appear to be more rapidly fatal when injected into rats or guinea-pigs.

This organism is of particular importance as it occurs in nature. It is also capable of conveyance by mosquitoes of certain species. The larvæ of many species of mosquitoes breed freely in more or less diluted fæces even in cess pits. Amongst these *Culex fatigans*, *Stegomyia fasciata* and *Stegomyia scutellaris* and sometimes *Anopheles Rossii* may be mentioned. A minute addition of sewage is fatal to few larvæ.

Under these circumstances as the larvæ contain in their intestines some of the organisms present in the water in which they live, it is not a matter of indifference to determine which of these organisms can be found in the adults and passed or conveyed by them.

Experiments (*vide note*) showed that Pyocyaneous can be conveyed in this manner by certain species of mosquitoes, and that the adults may therefore carry this organism to any substance on which they may alight, die

or deposit their dejecta. The reduction of the number of mosquitoes even of apparently harmless species is, therefore, of considerable importance.

Organisms corresponding to Shiga and Flexners B. dysentericus were isolated in many cases of dysentery from the intestinal contents, the ulcers and the scrapings from these ulcers. They were not found in the spleen or lymphatic glands even when enlarged, or in the Hepatic abscesses.

Dysentery is of rare occurrence in Europeans residing in the larger centres, but is common amongst those who do much travelling. Amongst natives resident in the towns it is fairly common, but more so in the small mines and in the bush. Gaol dysentery does not occur here, but in Singapore gaol epidemics of severe type of dysentery do occur. It occurs at all ages, but proportionally is more common from 25 to 35 than at other decades.

The water supply to European houses in Kwala Lumpur is from the Ampang Reservoir entirely. To the native quarters it is in part only from this source, more often from surface wells or even holes in the ground or from polluted rivers and streams. Milk is often mixed with water from such sources.

With dysentery there is not the same certainty that it is only derived from previous cases as in typhoid. On the contrary the evidence of travellers through uninhabited tracts of country strongly supports the wide spread belief that jungle streams are a fruitful source of the disease. This question will be further considered in dealing with the bacteriology of natural water supplies.

Dysentery was the cause of 17 or rather more than half the cases examined amongst the Tamils. The same types of Dysentery were found. In two cases there were Hepatic abscesses.

This greater liability to deaths from Dysentery on the part of the Tamils is, I believe, racial, but it must also be remembered that the Tamils are more careless as to the water they drink and the disposal of fæces.

NOTE.—Experiments were made by placing various larvæ in water to which cultures of various organisms were added and allowing them to develope in such water. Other food material and other organisms were present in the water but the persistence of those added was determined from time to time by plating. B. pyocyaneous, B. prodigiosus, B. violaceous, Sarcina lutea and B. subtilis were the organisms used. Shortly before pupation the larvæ were transferred to sterile water and after pupation changed frequently to different tubes of sterile water to remove as far as possible adherent organisms.

The mosquitoes as soon as possible after hatching were transferred to slope agar tubes and retransferred to other sterile tubes either dry or containing agar agar, and finally were allowed to die on sterile broth or were dissected on agar plates and these were then incubated.

The larvæ experimented with were those of *Culex fatigans*, *Stegomyia scutellaris* and *fasciata* and *Anopheles Rossii*. The results obtained differed with each species of mosquito. *Stegomyia fasciata* in every instance was found to carry B. pyocyaneous, some of the tubes giving pure cultures of that organism. In none of the other mosquitoes used was this organism found. B. violaceous was found in none of the tubes used by the mosquitoes, B. prodigiosus only exceptionally, and B. subtilis in about $\frac{1}{3}$ of the tubes. Sarcina lutea was carried by *Culex fatigans* in a few instances only. Moulds of various kinds were common with all, but most abundant with *Stegomyia scuttellaris*.

Mosquitoes caught in various districts were examined in a similar manner. A few specimens *Stegomyia fasciata* were found with B. pyocyaneous, and one specimen of *Wyeomyia splendens*, a pure bamboo breeder, also harboured this organism. In a few specimens of *Culex fatigans*, *Anopheles Rossii* and *Desvoidea fuscus* an organism resembling B. Coli but not coagulating milk was found. This organism appears to be closely related to the water organisms of this class so common in Malaya. Experiments with B. typhosus failed in every instance. Organisms, therefore, may be acquired as larvæ from sewage or other sources and conveyed by the adult mosquitoes to water, fruit, sugar or any other substance.

Beri-Beri.

Beri-Beri still continues directly or indirectly to be the cause of a considerable proportion of the total mortality. It is no longer epidemic or endemic in the gaol or other public institutions, so that the observations which are most needed, those on the onset of the disease, have been impossible.

The rapidly fatal cases are now exceptional in the hospitals, and where a history was obtainable one-third of the patients had been ill for three months or more, nearly all the others for over one month. The shortest histories were of 10, 12, 19 and 20 days respectively, and these were not reliable.

The duration of the Acute or prodromal Beri-Beri described by Dr. Hamilton Wright was therefore passed in these cases, and I am, therefore, not in a position to confirm or develope his observations on the pathological changes in that period.

The patients, 838 in the past 12 months, were mainly from the surrounding mining districts, but 76 were from the town itself. These may have been late relapses, but in the gaol there have been in the past 18 months four cases with no previous history of Beri-Beri who developed the disease more than two months after admission to gaol. It appears, therefore, that the source of infection is still present in the gaol and probably in the town also.

The history of the outbreaks of Beri-Beri at the Pudoh Goal have been the subject of many careful enquiries and much investigation. The first Director of this Institute, Dr. Hamilton Wright, in Studies No. 2, published full statistics up to May 1st, 1903. Dr. H. E. Durham in slightly different form also published statistics "*Journal of Hygiene*," January, 1904. Detailed statistics up to a later date have been published by the State Surgeon, Selangor, E. A. O. Travers, M.R.C.S., "*Journal of Tropical Medicine*," September 15, 1904, as well as previous accounts of the earlier outbreaks.

In continuation of the statistics published in Studies No. 2 the following figures are of interest as showing the decline of the outbreak there described. I have excluded cases in which the patient was suffering from the disease on admission and those which were observed in prisoners awaiting trial. In the fourth column only cases are included in which no previous history of Beri-Beri could be obtained. The frequency of relapses even after considerable periods and with apparently no probability of re-infection renders this subdivision necessary, but it must be admitted that these relapses are more frequent when fresh cases are occurring, and it is noteworthy that though the diminution in the number of relapses was less rapid than that of fresh cases, still, during the period of 7 months when no fresh cases occurred, there were no relapses. Many of the relapses are probably re-infections so that the third column under-estimates the real number of fresh infections.

The figures show a rapid decline in the number of fresh cases towards the end of 1902, followed by a cessation of fresh cases for a period of 7 months, and since then in the last 13 months occasional cases have occurred but no epidemic. During this time there was one period of 4 months and one of 2 months in which only relapsed cases occurred. During the whole period there were 22 cases commencing in the gaol and of these 18 had no previous history of the disease, some of the others were certainly

relapses with histories of frequent relapses. The remainder may or may not have been re-infections. Amongst the population from which the prisoners are drawn in Selangor, from about 3 cases per 1,000 to some 100 or more per 1,000 are the proportions per annum.

1902.	Rainfall.	Total Cases.	Deaths.	1st. Attacks only.	
May	12.13	90	6	64	S.W. Monsoon.
June	4.33	83	5	49	
July	3.83	67	7	38	
August	5.11	76	2	26	Sept. 23rd. Extramural work. Meals, except evening one, outside cells.
Sept.	8.74	131	7	28	
October	22.29	99	5	32	Oct. 20th. Kanji cooked at 3.30 a.m and served out hot 5.30 a.m.
Nov.	16.44	35	2	4	
Dec.	13.83	55	3	11	N.E. Monsoon.
1903.					
January	6.22	22	1	6	
Feb.	5.44	—	—	—	
March	10.50	—	—	—	Greatly improved ventilation of cells.
April	7.62	—	—	—	
May	13.50	—	—	—	
June	5.44	—	—	—	S.W. Monsoon.
July	4.31	—	—	—	
August	6.45	—	—	—	
Sept.	4.46	1	..	1	
October	9.89	1	1	1	
Nov.	5.63	1	..	..	
Dec.	15.39	..	..	..	
1904.					N.E. Monsoon.
January	12.92	..	..	..	Extra-mural work stopped Jan. 22. Meals taken in cells.
Feb.	5.34	2	..	..	March 9th. Extensive excavations for foundation of stonebreaking cells. S. S. prisoners only.
March	4.55	5	..	3	
April	12.24	1	..	..	April 9th. Meals taken outside cells.
May	8.47	..	..	..	

1904.	Rainfall.	Total Cases.	Deaths.	1st. Attacks only.	
June	3.80	2	..	1	S.W. Monsoon.
July	7.88	6	..	3	
August	4.10	2	..	..	
Sept.	..	1	..	..	N.E. Monsoon.

The exclusion of cases admitted with the disease is made as the gaol conditions cannot be held responsible. Prisoners awaiting trial have not the same medical examination and are under different conditions so these also are excluded. In the tables published by TRAVERS these classes of cases are included.

The average gaol strength is about 500, so that the incidence of the disease was not extraordinarily heavy.

There is also reason to believe that some of these cases were infected previous to their term of imprisonment. Of the 8 fresh cases one developed the disease within a week of admission and 3 under 2 months. Some at least of these may have been infected before admission. Of the other four cases one had been 7 months in gaol, 2 10 months and one a year. These, I consider, prove that the source of infection still exists, or is, from time to time, introduced amongst the prisoners, and that the conditions necessary for the spread of the disease still exist to a minor extent. Between November 1st, 1903, and September 30th, 1904, there were 9 cases admitted with the disease not included in the above lists. Three of these were admitted in November. No prisoners were admitted into the gaol in the previous 8 months with the disease. The cases occurring in the gaol before this date were both under two months after admission. The first cases which occurred (3), 7 months or more after imprisonment were in the following March, and in that month also two persons were admitted with the disease.

It has, I consider, been proved that the period of incubation of the disease is variable, and also that it may be short, but it has not been proved that it may not be as long as two months or even longer. It would appear probable that the source of the outbreak is to be found in the admission of prisoners in the incubation period and its continuance to the introduction by them of the disease into the goal.

A similar sequence of events occurred in the Singapore gaol at the commencement of the outbreak there in September, 1903. There had been no fresh cases for over 3 months, but one occurred in September in a prisoner 5 weeks after admission. In October there were two cases in short sentence prisoners, but one of these had been over 3 months in gaol. In November there were 32, including 6 who had been over a year in the gaol, and in December the epidemic reached its maximum of 41 cases, including 5 who had been in gaol over a year.

The incidence of the disease in the first 5 months of the epidemic was heaviest amongst the short sentence prisoners, 64 cases, and amongst the lower grade prisoners in the first year 13. The average strength of these

classes was 368, so that they were affected in this period at the rate of 209 per 1,000 or 501·6 per annum.

In the middle grade, prisoners who had been over a year in gaol, 13 were attacked in the last 2 months of the same period. The average strength of this grade is 284, so that the incidence was at the rate of 45 per 1,000, or 270 per annum per mille.

The upper grade prisoners escaped the infection. Two cases which occurred amongst them had only just been transferred from the middle grade.

A reduction in the diet of the short sentence and lower grade prisoners was made on October 1st at the Singapore Gaol after the occurrence of the first case, but the change did not affect the middle grade prisoners who were also attacked.

At the Pudu Gaol no changes were made in the diet during the whole period. The food was procured in the same manner from the same contractors, and no alteration was made in the method of cooking with one exception, and that was that from October 20th the morning rice, kangi, was cooked at 3.30 a.m., and kept hot till served out at 5.30 a.m., instead of as before being cooked at 5 p.m., and not prevented from cooling before being served out in the morning.

In the distribution of the food a change also was made, as all meals but the evening one, at 5 p.m., were served and eaten in the corridors instead of in the cells.

Another important change was effected in that confinement in cells was considerably reduced, and as much as possible the prisoners were employed in extra-mural work in open sheds from September 23rd, 1902. Early in 1903 the cell ventilation was greatly improved but was not completed till May. A few cells, as an experiment, were altered between November, 1902, and January, 1903.

It is difficult to believe that the cessation of the outbreak and the important changes effected in September and October are mere coincidences. The long spell during which the gaol was free from the disease exceeds any of the previous but shorter periods which have occurred, and the present position of affairs is not unlike the condition in 1898 when there were from January to September inclusive 42 cases with one death only.

Dr. Travers informs me that during this period the prisoners were kept at extra-mural work. 192 cases with 34 deaths occurred during the previous seven months from June to December inclusive. During that time the prisoners were working inside the gaol.

It can be claimed as a result of the careful attention paid to details of sanitation by the State Surgeon, Dr. Hamilton Wright, Dr. Durham and others, aided by the active and cordial assistance of the gaol officials and the support of the Government, that the gaol is as free from sanitary defects as possible, and that the condition of health of the prisoners is the highly satisfactory result of such attention.

The actual total mortality for the gaol in 1903 was 8 only, or 16 per 1,000 as compared with a general mortality of over 30 per 1,000, and a town mortality, including institutions, of rarely less than 60. The Indian prison mortality, 24.85, is 6.6 less than the general mortality. As in India the general mortality includes a far larger number of children than in this country a greater difference would be expected there than here. Our results therefore when compared with India are even more satisfactory than

is shown by the figures. The mortality for the first 9 months of 1904, exclusive of executions, was 8, or 21.3 per 1,000. Of those 16 deaths, 5 were of prisoners admitted to gaol with Tuberculosis. Two were from Beri-Beri.

The diminution in the amount of Beri-Beri and the cessation of the epidemic in the Kwala Lumpur Gaol does not lend any support to the purely dietetic theories of the causation of the disease. The course of both the slight recrudescence at Kwala Lumpur and the epidemic in Singapore Gaol are indicative of human agency as a factor in the transmission of the disease.

The monthly rainfall is given in the table in a separate column for comparison. There is no evidence of any relation between this and the epidemic, but as the prisoners are protected from the rain the conditions are not comparable with those in mines.

An important point in connection with the recrudescence of the disease in the Pudu Gaol is the unusually mild character of some of the attacks during the period under review. There was one death in all out of the 31 cases, *i.e.*, 22 cases originating in the gaol and the 9 admitted with the disease. This fatal case was a severe one, fatal in 24 days after the onset. Two are still in hospital.

Out of the remaining 19 patients who developed the disease in the gaol 5 were a week or less in hospital, 5 two weeks or less, and 5 a month or less.

The prisoners are discharged as fit for work, though for a few days they are kept under observation at light work. The medical officers attending the prisoners and the prison officials are very familiar with the course of the disease and the peculiar risks, and consequently this short detention in hospital is certain proof of the mildness of the attacks.

Outside the Public Institutions.

The disease is widely distributed and occurs not only in mines but in towns and villages to a variable extent. Exact information as to the rate is not available as the number of cases admitted to a district hospital does not represent the full number of cases that occur, as some particularly mild cases are not taken to hospital and others are taken to hospitals in other districts.

Taking hospital statistics as the only basis and realising that such calculations are only approximate and below the true figures we find that in Kwala Lumpur itself there were, amongst the labouring male population, 76 cases, or about 3 per 1,000 in the year. No figures can be obtained for the women. Several cases are known to have occurred amongst the inmates of the crowded brothels. In the adjoining mining districts of Ampang and Pudu there were respectively 149 and 64 cases, or about 13.8 and 11 per 1,000. In the mining districts round Kuala Kubu in 1903 there were from the old established mines of Rasa 18.6 per 1,000 and Rawang 29.3 per 1,000, whilst the outlying districts with small mines Kepong, Pretah, etc., the rate was 65 to 120 per 1,000 per annum.

Dr. Watson informs me that in the coast district under his charge a considerable number of cases come from the only tin mine in the district, and that isolated cases occur from time to time not only in persons on the coast who have never been inland but occasionally in persons working in lighthouses, launches, etc.

It is clear, therefore, that though a disease which is more readily acquired in crowded mining districts it occurs also in overcrowded towns and houses and occasionally under other conditions.

Race.

There is a tendency to attach too much importance to the question of race in considering this disease, because in the Malay States the Chinese suffer most severely, and cases amongst Tamils, Malays and other races are rare. Wider experience has shown that under some conditions Europeans, Negroes and Indians are all highly susceptible, and that, therefore, the condition that leads to the more serious implication of the Chinese cannot be one of race directly. It is to race customs and habits or modes of life that difference in incidence in different races must be attributed.

Occupation.

The enormous majority of the imported Chinese are or have been employed in the mines. The greatest number of cases of Beri-Beri are among those now employed on the mines, but cases occur amongst those otherwise employed. Out of 76 cases which occurred in Kwala Lumpur and 237 in neighbouring villages, 313 in all, 192 were miners and 50 were coolies. The remaining 61 were engaged in miscellaneous employments. Engaged in open air employment were 7 gardeners, 5 ricksha pullers, 3 woodcutters and 1 hawker. The licensed ricksha men number 2,499, but as there are only 1,811 licensed ricksha and few private ones the probable number working at one time is about 2,000, so that the incidence of the disease is about 2.5 per 1,000, much less than in the healthiest mines or in the gaol, though the quarters occupied by the ricksha pullers are as overcrowded as most crowded mines and much dirtier. Even the approximate numbers engaged in other pursuits cannot be obtained.

Cases also occurred amongst those engaged in work under shelter, these included 4 cake sellers, 3 carpenters, 2 tailors 2 shoemakers, 2 barbers, etc.

At most of the larger mines at one time or other the disease has been severe and even now there is not a mining district where cases do not occur.

Amongst the agricultural population on the rubber estates or sugar estates Beri-Beri only exceptionally occurs. The Chinese and other coolies employed on the roads and works in connection with the Gombak electric power station were not attacked. In these works Malaria and Dysentery were very common, and the conditions of life on the whole worse than in a mine. They were also engaged in turning up new earth and cleaning new jungle, both classes of work popularly believed to be direct causes of outbreaks of Beri-Beri, and although these facts appear to indicate that the occupation of mining is an important factor in the causation of the disease, yet the high rate in the gaol for many years, ship epidemics, etc., show that this is not an essential.

Case Mortality.

This is variable in an indefinite manner. In the gaols where a case can hardly be overlooked and errors of diagnosis have been carefully

warded against the mortality has varied since in 1895 as shown in the table:—

—	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Cases	158	478	275	73	73	180	205	891	29	19
Deaths	34	42	54	2	7	7	5	55	2	...
Case Mortality ...	21.5	8.75	19.5	2.75	9.5	3.9	2.5	6.25	7.1	...

In hospitals many patients are admitted moribund and histories are difficult to obtain and unreliable, errors are necessarily more frequent. In many cases the patient is suffering from two or more serious diseases so that a large personal equation enters into determination of the cause of death.

It can, however, be definitely stated that in some districts the case mortality is constantly high and in others consistently low.

In the district hospital returns Kwala Lumpur the mortality amongst those from the town and immediate neighbourhood was 53 or 16.9 per cent.

In those examined after death nearly one half were found to be suffering from other serious disease, particularly from Dysentery, and, therefore, the figures from that district give too high a rate for uncomplicated Beri-Beri.

Three districts may be fairly contrasted to show the variation in case mortality in different places. It will be noted that the case mortality has no definite relation to the number of admissions :—

—	First half year 1903.				First half year 1904.					
	Rainfall.	Cases.	Deaths.	Case Mortality.	Rainfall.	Cases.	Death.	Case Mortality.	Percentage of Total Admission.	Number of Cases of B.B. per mille of mining population.
Kajang	27.38	103	...	...	32.88	120	3	2.5	33	29.5
Kwala Kubu	55.98	69	19	28.8	62.60	131	44	33.5	12	31.
Rawang	52.79	64	5	7.8	53.59	137	14	10.2	28	29.3

The first of these districts is largely an agricultural one, but out of the last 144 cases, 139 were miners, 3 had no occupation, and only 2 were gardeners, though the miners alone would employ over 500 gardeners. So that here also the incidence is mainly on the miners. In the two largest mining areas in this district Kajang and Semenyih the rates were 24 and

35 per 1,000 miners respectively. The other two districts are two mining districts with few people engaged in agricultural pursuits. The figures for the first half year 1903 were quoted by DURHAM for the first half year of 1903 the relative mortalities are comparable. The substantial correctness of diagnosis in the period was verified in each case.

Exclusive of Beri-Beri the ratios for Dysentery and Diarrhœa were practically the same in the three hospitals, and also for respiratory diseases, so that the variation in the proportion of Beri-Beri or in the case mortality is not due to differences in the popularity of the different hospitals.

There has been a steady diminution in the case mortality as well as in the number of cases in Selangor for some years. In 1895 3,781 cases were treated with a mortality of 18.7 per cent., in 1902 2,673 cases were treated with a death-rate of 12.15 per cent. The mining population in 1897 was 47,000, and Mr. DYKES, the Senior Warden of Mines, informs me that it was probably about 40,000 in 1895, in 1902 it was 70,000, so that the proportion attacked is little more than a third of what it was.

Post-mortem examinations were made in 34 cases.

Of the gross pathological lesions the most important and most constant was cardiac dilatation. As a rule both sides of the heart were dilated and rigor mortis of the cardiac muscle either absent or poorly marked. This dilatation is associated with a certain degree of hypertrophy, as the average cardiac weight was 315.81 grammes (normal 260, the average in Chinese suffering from chronic disease such as dysentery which puts no extra work on the heart, 161.26). In some cases this dilatation was extreme and in almost every case was marked and unmistakeable. More variable was the amount of effusion into serous cavities, the Pericardium, Pleura and Peritoneum in the order named were those most frequently involved. In some cases, especially those in which the subcutaneous œdema was excessive, there was effusion into all the serous cavities.

Cultures made from these fluids in all cases where it was possible soon after death were negative, and so were those from the cerebrospinal fluid.

The œdema is not limited to the subcutaneous tissues, the submucous, such as that of the intestine, gall bladder, etc., was frequently involved.

The lungs in cases of excessive effusion showed of pulmonary collapse areas at the bases. In the great majority of the cases the lungs were œdematous.

The central and peripheral nerve lesions are fully described in the second part of Studies No. 2, by Dr. HAMILTON WRIGHT.

The early lesions according to Dr. HAMILTON WRIGHT and Dr. DURHAM are in the alimentary tract. According to Dr. DURHAM some congestion of the fauces is common, and organisms with peculiar characters were obtained in some cases. The occurrence of these organisms probably owing to the scarcity of early cases neither Dr. TUCK nor myself have been able to confirm, though the congested condition described was sometimes seen. Dr. HAMILTON WRIGHT laid great stress on the condition of the stomach and duodenum, and on the congestion in some cases of extensive areas of the intestines in early cases or in cases with acute exacerbations. This congestion is certainly common and was present in 13 of these fatal cases, and in two others the duodenum was markedly congested though the stomach was not. In two others there was marked congestion of large intestine though none of the stomach or small intestine. In four of the cases in which there was marked congestion the examination was made

within three hours of death, and in two of these within two hours, so that no question of post-mortem changes can be entertained. Though these changes appear to be common sufficiently so to form an important point in connection with the post-mortem diagnosis of the disease it does not appear to be certain that they are not in themselves secondary. Similar congestive changes occur in rabies and in other diseases affecting the nervous system.

Cultures from the contents of the viscera and from scrapings of the congested areas revealed no characteristic organisms, and those from the subjacent mucosa, from the glands, spleen, etc., were usually negative or showed organisms such as coli which enter the tissues from the intestine soon after death.

Marked and sometimes extreme dilatation of the stomach was a common factor and occurred both in congested stomachs and in those in which there was no trace of congestion. The stomach sometimes contained food showing so little signs of digestion that death must have occurred very shortly after the food was taken. Considering the cardiac condition it is possible that a more restricted or less bulky diet than rice is advisable in such cases.

In other cases the stomach contents were mainly fluid or contained food in an advanced condition of digestion.

The difficulty in deciding as to the real cause of death in some cases is great. Absence of patella reflex is not sufficient here to be diagnostic of the disease in an acute form. Many of the patients die almost immediately after admission and no history is obtainable. In such cases although no patella reflex was obtained if, for example, advanced tuberculosis, severe acute dysentery, peritonitis or advanced malignant disease is found at the autopsy even if Beri-Beri was concurrent the cause of death is not fairly to be attributed to that disease.

On the other hand a patient in the poor condition of health induced by chronic Beri-Beri, post Beri-Beric Neuritis, is liable to intercurrent diseases which frequently terminate fatally, and in these Beri-Beri is the primary cause of death.

The complications in the cases I have included in my list are as follows:— Dysentery, five cases in patients who had Beri-Beri for 1 to 11 months. Pneumonia, 1 case in an old Beri-Beri patient whose last relapse was five weeks before death.

Septicæmia, three cases. This is a sequela that is a fairly common cause of death. These cases were two of extensive sloughing bedsores, in one of which infarcts were found in the spleen, and a third with both buttocks gangrenous.

In these cases death was due to complications rather than to the disease itself.

Two of the patients had old tubercle, but neither extensive nor generalised. Two had cirrhosis of the liver. Two had renal calculus.

In nearly one-third of the deaths regarded as due to dysentery the initial diagnosis on admission was of Beri-Beri on the ground mainly of the absence of Patella reflex. Whether or not the patients had also Beri-Beri in an acute form may be doubted, but the post-mortem lesions of dysentery were severe enough in themselves to have been alone the cause of death, and I have, therefore, included them in the returns for dysentery, not in those of Beri-Beri. In this connection it must be remembered that a form of para plegia following an attack of dysentery is not unfrequently met with in

countries free from Beri-Beri, and that this paralysis is also associated with loss of patella reflex.

Of 34 cases of Beri-Beri in which age was determined, 6 were 25 and under, 24, 40 and under, and only 4 over 40.

In conclusion. There is nothing in the above to show that a poor diet is a necessary factor. The food in the gaol as far as can be ascertained has been of the same quality as in 1901 and 1902. It appears to be of good quality and to contain a sufficiency of essentials. The prisoners appear to be well fed and in good condition. In the mines the food is abundant and of great variety. The miners can and do supplement the food supplied with various additional articles of diet. The wages earned are high, the work is not excessive, and the men appear to be in excellent condition. Great attention is paid to the cooking in the mines and it appears to be thorough. The food is well cooked in the gaol. The change made in not allowing the morning cooked rice to stand overnight is one of the possible causes of the diminution of Beri-Beri, but in spite of this change cases have certainly originated in the gaol since, and in a proportion as great as amongst the general population, and greater than in Kwala Lumpur itself.

The theory advanced and supported by Dr. Hamilton Wright that Beri-Beri is communicated *viâ* the excreta from man to man receives some support from the course of the recrudescences of the disease in the Singapore Gaol and in the Pudu one, in as far as it supports the view that man himself is the carrier. Opportunities of contamination of food, etc., by the excreta are numerous in the Singapore Gaol, and the prevalence of dysentery in that gaol supports the belief that it does occur.

Opportunities also occur in the Pudu Gaol as the excreta are passed in the cells during 14 hours out of each 24, and though now the chances of contamination of the food are reduced by the food being served outside the cells, this does not entirely prevent chances of contamination. A proof that it does occur is that one fatal case of Typhoid developed after 4 months imprisonment in 1903, and in the same year one fatal case of Diarrhœa also after 4 months.

In 1904 up to September there had been two fatal cases of dysentery, one in a prisoner who had been over 4 years in the gaol.

The water supplied direct from the town service reservoir is boiled before use for drinking purposes in the gaol, so that it is improbable that either these cases of intestinal disease or of Beri-Beri were carried by the water.

The smaller amount of Beri-Beri in old established mines and in towns overcrowded for years such as Kwala Lumpur, as compared to new mines or to the same places a few years ago, does not support the view of ground or place infection.

Enteric Fever.

Typhoid Fever presents the same symptoms as in England though the temperature is not so high and is more irregular. In one case out of the five the solitary glands of the large intestine were implicated but not to so large an extent as sometimes occurs in British Guiana. In two of the cases death was due to perforation and peritonitis. Cases are not uncommon amongst Europeans living in Kwala Lumpur as well as

elsewhere. In all probability the only method in which Typhoid infection occurs here amongst Europeans is from water. The main water supply of the town is drawn from an area free from human habitation and rigidly reserved. Fœcal contamination with Typhoid dejecta is almost impossible. The town service reservoir is on an isolated hill, has no houses above it, is well covered in, and free from any possible source of contamination. There is no reason to suspect contamination of the water during delivery. Unfortunately considerable areas in and close to the town are not supplied by this water and the water used is derived from wells and pits in many cases situated close to drains contaminated by sewage and so may easily become infected.

The areas not supplied by town water include all the larger cattle stations. Water derived from any source is freely used either for washing utensils or for diluting the milk, and it is to this milk that the cases of Typhoid occurring amongst Europeans who use town water only for drinking purposes is probably to be attributed, as it is often not boiled before use.

There is little likelihood of the disease being either dust born or fly born in this country amongst Europeans. Except on the roads in long spells of dry weather there is little dust and flies occur only in small numbers in well kept houses.

With the Chinese the conditions differ greatly. Town water is not supplied to all parts and surface wells are freely used. Very little unboiled water is used by the Chinese for drinking purposes, but it is used for washing utensils, vegetables, etc.

In the crowded parts of the town dust is present in abundance in houses, gambling farms, theatres, etc. Examination of samples of dust taken from various places of public resort, from lodging houses and brothels, resulted in finding B. Coli communis in 66% of the samples taken. Even during wet weather the dust in these places is abundant and easily disturbed. Dust, therefore, cannot be excluded from amongst the sources of Intestinal disease amongst the Chinese.

In some of the Chinese houses flies, *Musca domestica*, and several species of Lucilia and Sarcophagi are abundant. The Chinese methods of disposal of excreta is probably ultimately destructive to pathogenic organisms, but in the early stages of the process before this destruction has taken place these flies may convey disease.

There is no evidence that the *larvæ* of these flies bred in the excreta harbour as *imagines* the human intestinal bacteria. As far as experimental work has gone even B. Coli communis does not seem to be carried in this maner.

In the country districts the water supply is often inferior. Any stream or river passing through a mining district is always contaminated with excrement. Such water can usually be recognised at once, as much of the washings from a mine consist of finely divided white clay which remains in suspension in the water for prolonged periods.

Surface wells are usually contaminated. It is common to find such wells in the immediate vicinity of drains, cesspits, and houses even in moderate sized towns or in Government institutions. It does not seem to be sufficiently realised that the area from which a surface well draws its water is considerably greater than a circle three or four times the depth of the well in diameter.

Plague.

Two cases of Plague were detected in the course of ordinary Post-mortem examinations. Both the patients had been picked up dead or dying in the street and taken to the hospital.

In neither case were there any visible buboes nor were the lungs affected. In both there were subserous hæmorrhages, and in one there was a large perirenal hæmorrhage and in the other there were hæmorrhages into the substance of and on the surface of the left inginual glands which, however, were not appreciably enlarged.

In both cases the diagnosis was made from smears and confirmed by cultural methods.

Another case occurred in hospital at Kwala Lumpur, a definite bubonic case, also confirmed bacteriologically. The detection of these cases led to the location of the centre of the disease at Kwala Kubu and some 14 cases all confirmed bacteriologically subsequently occurred. Strict isolation of contacts, etc., was enforced, and the epidemic did not assume formidable dimensions. No other cases occured in Kwala Lumpur. There was a history of mortality amongst rats at Kwala Kubu previous to the detection of the epidemic, and in previous small epidemics rats as well as men have been found to be infected, so that conditions here are such that the disease does spread amongst both man and rats and yet has never spread to any great extent and has always been suppressed shortly after the discovery of each outbreak with very small loss or expenditure. The disease is very virulent and in every known case death has occurred.

Cholera.

There was one small outbreak of Cholera near Kwala Kubu. The diagnosis was confirmed bacteriologically. The water from several wells was examined and one in particular was found to be infected and closed. There was no further spread of the epidemic.

No cases of Cholera have occurred at Kwala Lumpur. One case was suspected on account of the symptoms and the character of the stools. The post-mortem appearances were not incompatible with that diagnosis. Bacteriological examinations and cultures of scrapings and of the "rice water" intestinal contents showed the complete absence of vibrios. Almost pure cultures were obtained of an organism indistinguishable from the B. Coli communis. Similar suspicious cases seem to occur from time to time. Samples sent either of excreta or intestinal contents in such cases are free from Koch's Cholera organism. In no instance have other cases occurred in relation with them, and the disease appears to be neither infectious nor communicable to any important extent.

Sepsis.

The deaths from sepsis, exclusive of extensive and gangrenous bed sores in Beri-Beri cases, include two cases of gangrene of legs; Necrosis, two; Suppurative Nephritis, two, one of them associated with suppuration in the Prostate and the other with renal calculi. In one case there was a large perineal abscess and fistula with ulceration of the duodenum.

There was one case of ulcerative endocarditis, another of acute pericarditis and peritonitis the origin of which could not be traced, and in yet another case there was an abscess in the muscle substance near the apex of the heart. In the last case there was an old sinus in the axilla.

I include in this series a large solitary splenic abscess. As is usual with such splenic abscesses there was no other associated disease and no ulceration of any part of the alimentary tract. No amœbæ were found. The abscess had been opened during life by operation and had also burst into the peritoneum. Various bacteria were found in the contents of the abscess but were probably secondary.

Cultures made from blood or spleen in the cases of Sepsis showed the organisms to be Staphylococus pyogenes aureus and not Streptococci. This prevalence of general infections by Staphyloccocus renders it unlikely that good results could be anticipated from the use of antistreptoccic serum.

As regards lower animals. The septicæmia of rabbits is a cause of heavy mortality amongst them. It appears to originate *de novo* and affect simultaneously four or five. Prompt removal of the other unaffected rabbits from the flock and successive removals if any more are attacked usually suffices to limit the epidemic. The organisms are found usually in pure culture both in the affected lungs and in the cardiac blood, and are those commonly described for this affection.

Though fatal to guinea-pigs when injected intraperitoneally it does not seem to be communicable to them under natural conditions.

Hæmorrhagic Septicæmia in cattle has not been observed by me. This disease is so frequently confused with Rinderpest that it is possible some of the described epidemics of Rinderpest may have been Hæmorrhagic Septicæmia, but there is no satisfactory evidence that such is the case. The outbreaks of Rinderpest in 1903 and 1904 were certainly that disease and not Hæmorrhagic Septicæmia.

Rats do not appear to develope any epidemic disease either naturally or in confinement here. Many organisms, some of them occurring in natural waters, were fatal to rats when injected, but other rats confined in the same cages were not infected. The same organisms given by the mouth in food produced no effect. These experiments were made with a view to the destruction of rats, as this is a matter of first importance in connection with Sugar and other plantations.

Infective Granulomata.

Of the infective granulomata other than Tubercle and Leprosy, Syphilis is the most important. Syphilitic lesions of the internal organs were found in 7 cases and were definitely the cause of death in 2. In many other cases there were external lesions, of the disease. On the whole, considering the frequency of the disease, the small mortality, the absence of cerebro-spinal cases, including Tabes dorsalis, is satisfactory.

The only special lesion that is of importance because so often overlooked and so likely to be confused with dysentery is the Proctitis referred to in that connection.

Two of the cases included on account of their symptomology with Malignant disease probably belong to the class of granulomata. In neither case was there any evidence of syphilis.

Yaws occur amongst the Sakies (aboriginal inhabitants) of Malaya in some of the remote districts. *Vide* Report by Dr. GIMLETTE "Notes on some Methods of Employed by Kelantan Malays in the Treatment of Puru or Yaws."

Yaws locally known as "Puru" is also a common disease amongst the Malays on the Pahang River. In every village visited cases were seen in some of the children. Children in arms and up to about 10 or 12 were affected. No cases were seen in adults. Many of the other children had scars from this disease indicating comparatively recent attacks. A considerable proportion of the children are not attacked, and in this the condition differs from that in Fiji where the disease is universal amongst the children. The scarcity of flies and the smaller houses are probably sufficient to explain the difference. Various forms are distinguished by the natives as in Fiji and in the West Indies. These distinctions are based on the arrangement and amount of the eruption on the parts mainly affected. The eruption itself is characteristic and indistinguishable in appearance and in course from the Yaws of the West Indies, West Africa and Central Africa and the "Coko" of the Fijians. A primary sore usually on the feet legs or hands is recognised in most cases. These are the places most exposed to injury and it is probable that infection takes place in the great mass of cases through some breach of the cuticle.

So much has been written on the relationship between Yaws and Syphilis and the statement that Yaws is merely a racial or climatic modification of Syphilis that it may not be out of place here to state that I have now seen Yaws in different races of Negroes, Chinese, Natives of various parts of India, Portuguese, English, Polynesians, Melanesians and Malays, and in the offspring of various combinations of several of these races. I have also seen the disease in such different climates as those of Fiji, British Guiana, Central Africa, West Africa and Malaya. In all these climates and amongst most of these races Syphilis also occurs and the two diseases are easily distinguishable from each other and "breed true."

The disease in Malaya is probably indigenous.

In the lower animals granulomata appear to be uncommon. The granuloma affecting the genitalia of dogs, common in many tropical countries, has not been seen here.

Glanders has been recorded but no case occurred during the period under review.

An imported horse which had been many months in the colony and in apparently good health gradually began to lose condition, a chronic irregular fever set in with exacerbations of more severe fever and later subcutaneous swellings appeared. At first these were only on the hind legs but later on the fore legs also, the abdomen and the neck. These swellings varied in size, they were not hot and were moderately soft. When advanced distinct fluctuation was obtained. The swellings, whether allowed to burst naturally or opened, discharged glairy yellow fluid or thick pus. The ulcers formed healed fairly readily in some instances and in others slowly or incompletely breaking down again.

More of these swellings continued to form as the old ones healed, and later yellow thick fluid streaked and stained with blood was discharged from time to time from the nares.

Blood examination was negative except on the occasion when Mr. FORD found an embryo filaria. The result of injections of blood

into rats and guinea-pigs was negative and so were cultures on various media.

The animal rapidly emaciated, fever continued, and ten weeks after the first observation and little more than three months after the first symptoms were noted the animal was killed. It would probably not have lived more than two or three weeks more.

Post-mortem examination showed no visceral lesions and all the organs appeared healthy.

The vomer was covered to a great extent on both sides by areas of course granulation tissue raised above the surrounding mucous membranes. A narrow zone of intense congestion surrounded the smaller areas so affected.

Sections of the subcutaneous tissues and of the growths on the vomer showed masses of round celled growth. The surrounding connective tissue was little thickened. There was no caseation, but towards the centre of the larger masses the cells stain feebly and appear to be degenerate. The vascular supply to the growths is scanty. No organisms were found in the deeper parts of the growth.

The disease appears to be closely related to if not identical with that described in Manila as Pseudofarcy. The resemblances to glanders are entirely superficial. No growths of the organism of glanders were obtained, and injections made into animals susceptible to glanders all failed.

No other instances occurred either in the stables occupied by other horses adjacent or elsewhere, and though a certain amount of care was exercised it would not have been sufficient to prevent the spread of any highly contagious disorder.

Malignant Disease.

Malignant growths were noted only in Chinese. The number of Tamils, 32, was too small for any conclusion to be drawn from the absence of such cases, and as no post-mortems were made on Malays no information is obtainable as to the frequency of inaccessible malignant growth in that race.

Malignant growth was present in 10 cases. These post-mortems were in several instances selected and probably represent all or nearly all the cases that terminated fatally from that cause during the period under review. The total deaths were 805, so that the percentage of the deaths was not less than 1.24.

The different age periods of deaths from all causes of those examined was 25 and under, 6.1 %; 30 and under, 22.1 %; 35 and under, 19.6 %, or 50 % under 35; under 40, 16.8; 45 and under, 13.5; 50 and under, 8; 60 and under, 9.4; and over 60, 3.7. These ages must be received with caution and considered as estimates only. Accurate information is not obtainable and in many cases no information at all could be obtained. Of the cases of death from Malignant growth, 7 or 70 % were over 35, i.e., 2 over 50, 2 over 45, 2 over 40, and 1 over 35, and the ages given for the other 3 were 28, 30 and 33 respectively.

Two of the cases were in persons who had been over 25 years in Malaya, and, therefore, must, I consider, have acquired the disease in the country. One had only been one year from China and possibly had not acquired it in this country.

The organs involved are shown in tabular form :—

Liver.	Stomach.	Pancreas.	Lungs.	Orbit.
7	3	2	2	1

In 5 the liver was primarily affected, in two it was secondary to disease of the Stomach or Pancreas. In the Pancreas it appeared to be primary in one case. In the lungs in both cases the growth was secondary. In the orbit it was primary.

The enormous preponderance of Hepatic Malignant growth was not limited to the District Hospital, similar cases were met with at the General Hospital and elsewhere. It is a common feature of the distribution of malignant disease in other tropical countries as in British Guinea, and is not restricted to any one race, as there I have observed it in Negroes, Indians and half castes.

The primary hepatic cases are all of one type and are mainly composed of hepatic cells not cells of the biliary ducts.

Clinically the marked feature and the earliest to attract attention is abdominal enlargement due in part to ascites. The fluid is blood stained in some cases, so much so as to appear to the naked eye to be almost pure blood. This occurred in two of the cases here. Red corpuscles little altered are found in the fluid, and spontaneous coagulation may occur. Sometimes when first tapped the fluid may be clear but at subsequent operations blood stained. There was no jaundice in these cases.

The liver is always enlarged and may be felt to be nodular. The growths are multiple but vary greatly in size and in number. In three the growths were scattered all through both lobes. In the other two one growth was much larger than the others and the other masses were only distributed in the one lobe.

The surface of the growth is always convex and on section shows no cupping or contraction. The consistence varies but is never hard or fibrous and may be so soft as almost to give the impression of fluctuation. The growths show no tendency to break down or undergo any form of degeneration beyond fatty and pigmentary changes. They may be entirely yellowish white and are usually pale in their greater part, but may be parti-colored and sometimes appear to be lobulated.

In one case there were secondary deposits in both lungs but not elsewhere.

On microscopical examination the growth is seen to be composed of large cells, with abundant protoplasm, irregularly hexagonal in shape. The cells differ from normal hepatic cells in that the cells stain more readily with basic stains, are somewhat larger and more irregular. The arrangement is in clumps or columns. The tendency to the formation of columns is more marked in some cases than in others, and occasionally these columns are imperfectly tubular. The fibrous tissue is scanty but more abundant in some cases than in others. In none did it form, even in the central parts of the growth, dense masses. In a few instances the growth was divided by definite fibrous strands and in these in one specimen biliary ducts were present.

There was no definite capsule to the growth, but the surrounding hepatic tissue was formed of hepatic cells flattened and compressed.

In the one instance in which secondary growths occurred in the lungs the central part of each of the pulmonary growths contained cells similar to those in the hepatic tumour but the periphery of each growth was formed of alveoli filled with round celled exudation—secondary pneumonia.

The close resemblance to hepatic cells of the cells of the growth the absence of any alveolar structure and the non-implication of the glands are all in favour of an Adenoma rather than of a true Carcinoma. The growth clinically is Malignant to a high degree.

Classified according to the nature of the growth as determined by microscopic examination. There were Adeno carcinoma or Malignant adenoma, 5 in each case of the Liver. Carcinoma, 2. One of stomach and one of the pancreas. Sarcoma, 1. Granuloma of the Stomach, 2.

The Adeno-carcinoma of the liver is certainly the commonest malignant growth here. Three similar specimens in addition to these mentioned have been sent to me, and most of the Medical practitioners know of other cases. Sarcoma is more common than my figures would indicate. I have received in addition a specimen of Fibrosarcoma of the male breast from Dr. McCLOSKY. An enormous mass weighing 40 lbs. was removed by an Assistant Surgeon at Kwala Kubu from the abdomen at a post-mortem examination and was sent to me by Dr. DELMEGE. This tumour did not involve the abdominal viscera and appears to have been omental in origin. It was lobulated, contained much fat and several irregular cysts containing blood or altered blood and varied greatly in appearance in different parts. In parts the structure myxomatous and in others it was more the type of a spindle celled sarcoma. There were in other places strands of dense fibrous tissue and of imperfectly formed cartilage. There was no ossification. It was one of the mixed sarcomatous abdominal growths and had been steadily increasing in size for some months.

The two cases called "granuloma" are of a type new to me. In both the mucous membrane of stomach was extensively involved. The mass of the growth was imperfectly cicatrised and superficial ulcerated in places. The edge of the growth was raised slightly nodular and sharply defined from the unaffected mucous membrane. The cicatricial tissue was hard and inelastic so that the stomach retained its shape when removed from the body. There was no deep extension of the growth. The glands were not involved and there were no secondary growths in other parts of the body. In one of the cases the whole of the mucous membrane of the stomach was involved and the growing edge extended into the œsophagus and duodenum respectively. In the second the pyloric half of the stomach alone was involved.

Microscopically the growth was a round celled mass with outlying smaller masses not sharply defined. These scattered portions of the growth were found in the cicatricial tissue and in advance of the growing edge which was entirely composed of the growth.

No tubercle or other bacilli were found in the depths of the growth and there was no evidence of syphilis.

Specimens of Peritoneal Malignant growth in a dog and in a fowl were sent to me by Mr. FORD. In both cases the growths were extensive and were sarcomatious in structure.

General Conclusions.—Our main knowledge of diseases is of those imported into the States and of indigenous diseases as they affect imported races.

Effective quarantine combined with notification of infective diseases and local action are the main points on which to rely against the further importation of disease. In certain cases the effect of other measures should be to render conditions unsuitable for the spread of disease if imported. Amongst such measures a water supply free from chance of contamination will hinder

or stop the spread of introduced Cholera or Typhoid. The destruction of breeding places for *Stegomyia fasciata* will prevent the dissemination of Yellow Fever and that of rats limit the probability of the spread of Plague.

The most important of the indigenous diseases are Malaria and Dysentery. Further details as regards the causation of these diseases are given elsewhere. The main peculiarity of Malaria in this country is that it is a disease of hilly country and of certain alluvial districts near the sea, and that during clearing and draining such places are bound to be unhealthy. This period should be shortened as much as possible as when cleared or drained they cease to be malarious.

The most serious diseases probably imported but now firmly established are Beri-Beri and Tuberculosis.

Beri-Beri appears to be of rapidly diminishing importance, and though the true causation is obscure we do know that every improvement in the welfare of the people will further reduce its importance.

Tuberculosis on the other hand is steadily and rapidly increasing and unless energetic measures are taken promises to be the important fatal disease of the country.

Attention to sanitation in its widest sense and expenditure on it would in my opinion be even pecuniarily remunerative.

Notes on Certain Insect Pests affecting Plants.

The insect pests of the vegetable kingdom in the Malay States are numerous and destructive. In the grounds of the Institute a considerable amount of food has to be grown for various animals and in addition fruit trees and certain plants of economic value are cultivated.

It was hoped that those interested in such subjects might have been able to make a special study of the diseases of such plants as it could be more safely done in an isolated tract of land than in an agricultural district.

Certain preliminary observations have been made by the staff of the Institute and they show that the distribution of disease of this kind in the Federated Malay States requires careful and local study.

Sugar Cane, *Saccharum Officinarum*.—The "borers" affecting this plant in the large Sugar estates in Province Wellesley were the subject of a special study by Mr. Ridley, the Straits Settlement Government Botanist. He showed that the worst pest was a lepidopterous larva *Chilo saccharalis*, but that the canes were also attacked by larvæ of two species of Coleoptera *Sitophilus sculpturatus* and *Xylotrupes gideon*. In Selangor in the neighbourhood of Kwala Lumpur none of these borers are found but instead borers of two lepidoptora one, a Zeuzerid, which is very common and destructive and a smaller rarer one which does comparatively little damage. This moth, according to Mr. Robinson, is closely allied to *Phragmatæcia castanaæ*.

The Zeuzerid larva commits worse ravages than I have seen in any other part of the world in Sugar cane. If the caterpillar penetrates near the top of the cane the growing point is completely destroyed, if nearer the middle the growth is much retarded and the young segments formed are short and thin but if the cane survives later segments may attain nearly the full growth.

If the borer perforates the canes near the ground secondary effects frequently result, either termites obtain access and eat out the whole of the

interior of the cane for two or three segments, so destroying it, or ants get in and probably by carrying in and depositing earth set up destructive decay.

The first borers were noticed in cane about 4 months old. The older the cane the larger the proportion attacked. In ratoons practically every cane is affected.

The smaller borer beyond causing some diminution of the growth is comparatively harmless. It is identified by Mr. Robinson as a Crambid.

In Pahang none of the borers which were found in Province Wellesley and Selangor were found. In a few canes on the East Coast a lepidopterous larva, according to Mr. Ridley, a Pyralid, does occur, but the destruction caused is small. It has not been found elsewhere in the Federated Malay States.

It is noteworthy that the native varieties of cane are far less attacked by these pests than the imported varieties.

The original source and native habitat of these borers is unknown. The wild *Saccharum arundinaceum* is not attacked.

Scale insects are abundant in the axils of the leaves and appear to cause some destruction in ill-kept badly cleaned canes.

Till full information is obtained as to the distribution of the pests and particularly of the Zeuzerid larvæ great care should be exercised in moving canes from one place to another or this pest may be introduced and possibly under European conditions of cultivation thrive in districts at present free from it. I do not believe that on a large scale cane could be economically grown in any district where this pest occ urs.

Indian Corn, Maize, *Zea mais*, is not very extensively grown. It is not as in Africa the staple article of diet of any class. It grows well in manured land and can be cropped in from 10 to 14 weeks according to the weather. Few pests seem to cause much damage but the cobs are frequently attacked when nearly mature by a lepidopterous larva which in its passage up the cob destroys a certain number of the grains. The dry cobs are attacked by weevil, probably, according to Mr. H. C. Robinson, a Calandrid.

Millet, *Sorghum vulgare*—Like Indian Corn is only grown as a subsidiary article of diet. The native varieties have few and poor heads with small seeds. A West Indian variety introduced has numerous heads and large seeds and grows rapidly and affords an abundant crop. The young shoots are often destroyed by mole-crickets, and one of the few aphides found in the country is found on this plant.

The heads and nearly mature seeds are the parts most subject to disease and are attacked by two larvæ of lepidoptera both belonging to the Pyralid family as identified by Mr. Robinson. These heads are also liable to be attacked by fungus (smut) but whether secondarily to the attacks of larvæ or not could not be ascertained. The native variety of millet is not attacked by these insects.

The flowering stalk is often hollowed out by an adult hymenoptera or solitary wasp, a Sphegid.

Fruits of various kinds are subject to great variety of insect pests. The grenadilla, *Passiflora quadrangularis*, is much infested by Thrips in some cases and these destroy the pollens and tips of the stamens, according to Dr. Leicester, and so prevent fertilisation. Only some vines are so infested. When nearly mature dipterous larvæ are found in the thick seed

ase and cause necrosis. If they penetrate into the interior of the seed the ruit is destroyed.

The soursop, *Anona muriatica*, in some parts of the country particularly n the East coast is attacked by scale insects. These may be so numerous s to almost entirely cover the fruit and soon destroy it. Many other fruits re attacked by dipterous larvæ.

The trunk and larger branches of the soursop are often attacked by a ark caterpillar which in the earlier stages does little harm but before upating burrows into the axil of a small branch and there pupates. In the avity thus formed small black ants speedily resort and the branch usually lies.

Though the number of caterpillars attacking leaves, etc., is large the ctual destruction caused is less than might be expected. One of the most lestructive of the leaf caterpillars is the *Ereonota thrax* which lives on the eaves of all varieties of the Banana including the wild or jungle species. This caterpillar causes much destruction of the leaves as it separates a portion from the midrib and curls up this portion. Protected in the interior of this curled up portion the larva remains and eats at the edge of the leaf. Only a small portion is eaten and then the caterpillar proceeds to strip off another portion of the leaf which is similarly destroyed and finally it pupates in the centre of another curled up strip of the leaf. A single caterpillar therefore destroys a portion of the leaf far in excess of what it eats.

The stem of the banana is attacked by a Coleopterous borer—a weevil. The borer penetrates obliquely into the centre of the stem. A secondary decay occurs along the course of the track and the stem frequently breaks two or three feet from the ground whilst the plant still appears to be fairly healthy.

In other cases the central growing shoot dies whilst the rest of the plant appears still to be healthy.

The fruit are sometimes attacked by Lepidopterous larvæ.

Tubers of the sweet potato *Ipomoea batatus* are often destroyed by a small beetle larva, a Curculionid. In such a tuber every stage, the small larva, the pupa and the imago, will be found and the root will be riddled with the tunnels eaten out by these pests. Of the varieties of the sweet potatoe grown in the F. M. S. the whiter varieties are much more extensively attacked than the red ones even when they are both grown together.

The main stem of the sweet-potato is sometimes attacked by a Lepidopterous borer. The borer track extends along the stem below the ground and the whole plant dies.

On the whole the various scale insects and homoptera are probably responsible for more destruction than any other order. None of the species of orange, limes, etc., which in most tropical countries do so well are successfully grown in this country except in a few places. The *Lecanium irride* and a small black scale insect appear to be responsible for the poor growth of these plants.

A similar scale insect to the *Lecoinum viride* attack the Cinnamon and many other trees, whilst scale insects of various species abound on both forest and cultivated tree. Some of these form leaf galls, some attack young shoots and others leaves, leaf stems, or other parts of the plants.

It seems to me advisable to publish these few notes as the subject is of vast importance but has attracted so little attention from the general public.

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I am quite aware that much good work has been done on the subject by Mr. RIDLEY, ROBINSON, and others, and that isolated papers have been published and facts recorded, but a more systematic and complete investigation and publication of results in an accessible form is a matter, in my opinion, of urgency, as many insects with the increase of planting may find improved conditions of existence and become more widely destructive.

Specimens of the various insect pests found have been sent to the Museum for identification.

PART II.

A Preliminary Report on Natural Waters and the Effects of the Methods of Purification Adopted.

Water Supply.

General.—Intestinal diseases are the cause of so large a part of the mortality amongst the inhabitants of all nationalities of the Federated Malay States that an examination of the existing water supplies becomes of the highest importance.

Little has been published as to the minute flora of jungle streams in so uniform a climate as that of Malaya. The thick jungle and the heavy undergrowth provide abundance of vegetable matter to serve as a medium for the growth of organisms. These streams are so shaded that they are not exposed to direct sunlight or even to a strong diffused light and the temperature varies little from day to day or from day to night and is usually about 80 F. at the lower levels.

Under these conditions, as might be anticipated, the organisms are abundant and differ in type from those met with in temperate climates or in tropical climates where the rainfall is less uniform and vegetation not so rank.

The places selected for examination were, with certain exceptions, places where the chances of contamination with the excreta of man or of the domesticated animals were very small.

Jungle streams are the sources of nearly all the water supplies and are most of them in granite country. Samples were taken from streams, at an elevation of over 3,000 feet, on Treacher's hill, both from the side of the hill on which the Government Bungalow is situated and where slight contamination is possible and from the other side where no such contamination could take place. Other samples were from the streams entering the reservoir at the Ampang Water Works. The catchment area is rigidly reserved for the town water supply. From a similar stream and reservoir for the small island of Pangkor Laut and from the service reservoir supplied with unfiltered water at Klang. These sources are taken as examples of the natural water under natural conditions and unpolluted by man.

Other samples where the possibility of pollution was great were certain streams, surface wells, etc.

Method of examination employed.—The water was collected in sterilised bottles and carried, packed in ice, to the laboratory and examined as soon as possible.

The routine examinations consisted:—

(1) Of plating a known volumes of the water on agar or gelatine, or both.

(2) Of inoculating with varying amounts, .4, 2 and 5 cc. were the usual ones, a tube of MacConkey's medium, Bile salt glucose broth.

(3) Plating on agar and gelatine from the 20 to 24 hour old growth in this medium.

(4) Addition to Peptone water of 5 cc. and sometimes of other amounts of the water to be examined and testing for Indol at the end of 48 hours.

As determined by plating the number of organisms in all natural waters is very high as compared with European standard and the number when cultivated at blood heat is as great as at room temperatures and higher as a rule than in gelatine plates at 22° C.

For purposes of comparison the plates used were of Agar-Agar made with Liebig's Extract and neutralised so as to be of an alkalinity + 10 as tested by Phenolphthalein. The plates were kept at a temperature of 37° C., and counts were made up to the 5th day. Few new colonies are found after the third day whether the plate be kept at 37° C., in the cold incubator at 22° C. or at room temperature.

MacConkey's medium is, in my opinion, of particular value, and the absence of the formation of acid and gas within 24 hours is a certain proof of the purity of the water. It is not a test of sewage contamination as many natural waters will give the reaction even with .4 cc. or less. Amongst these waters is that found in the stems of upright growing bamboos which have been perforated by a borer and in which water is found. In such a stem with an aperture from $\frac{1}{4}$ to $\frac{1}{8}$ of an inch any contamination by animals except insects and other small invertibrates is impossible. The value of the medium is that it is a crucial test of the purity of water.

Plating from the growth in this medium is of considerable value.

For this purpose it is essential that young cultures preferably 24 hours old should be used as the more delicate organisms, those most closely related to the human intestinal organisms, pathogenic or non-pathogenic, are destroyed in the acid medium into which this medium is converted by the growth of organisms. If plated from older cultures, these organisms may not be found.

Plating from this bile salt broth in Gelatine is best as it is the non-liquefying organisms that are of importance.

In this manner from nearly all such waters short bacilli can be isolated which decompose glucose or lactose or both with the formation of gas or with the formation of acid only. They are non-spore forming are usually motile but vary in motility. They do not retain their stain when treated by Gram's method. Only a few of them curdle milk and that not for three or four days as a rule.

Few of them form indol and none indol and nitrites. Some are not pathogenic to rats or guinea pigs whether injected subcutaneously or into the peritoneum. Others are fatal when injected intraperitoneally but not when injected subcutaneously. An extensive local slough or pus may be caused or no lesion at all may result from the subcutaneous injection.

In appearance of growth they are often indistinguishable, and in any case from the non-pathogenic to the most virulent there is no more difference in the growth on Agar, Gelatine, Potato, etc., than in various laboratory strains of B. Coli communis to which organism they appear to be related.

The presence of these classes of organisms in minute samples of the water is indicated by the use of MacConkey's medium. Though not of the same importance as that class of organisms would be in a temperate climate I consider that such water should be viewed with suspicion.

It is rare to find water absolutely free from this class of organism when large quantities are tested. I consider that as a practical standard water could be passed as good in which no acid and gas formation occurred with MacConkey's medium in 24 hours with 2 cc. of the water to be examined.

Indol formation is much less common with the same bulk of water than the reaction with MacConkey's medium. The natural waters which contain the indol forming organisms also give the MacConkey's reaction though not necessarily vice versâ. In some instances though no Indol is formed in 48 hours from the water the deposit from this water contains organisms which will form Indol.

In practice I use 5 cc. of the water and add to peptone water and test for the reaction in 48 hours.

Even where 5 cc. give a reaction with MacConkey if no indol is formed in this time the probability that the water is injurious is decidedly diminished.

In giving an opinion of a sample of water it is, I think, advisable as a basis to consider :—

(1) The number of organisms exclusive of known easily recognised non-pathogenic organisms, e.g., B. subtilis, B. megaterium, B. prodigiosus, B. violaceous, and some of the organisms which form characteristic yellow colonies which have been proved to be non-pathogenic to lower animals.

(2) The amount of the water required to react, forming acid and gas, with MacConkey's medium, 2 cc., 1 cc. and 2 cc. will give a sufficient range for the natural waters here.

(3) Indol formation in 48 hours in Peptone water with 10 cc. 5 cc. and 1 cc. of the water to be tested.

Standard.

As a standard Dr. Finlayson, the Government Bacteriologist, Singapore, and myself have suggested that :—

(1) Not more than 100 organisms exclusive of those mentioned should be present in a 1 cc. of water.

(2) That no acid and gas should be formed in 24 hours in MacConkey's medium at 37° with 2 cc. of the water.

(3) That no Indol should be formed in Peptone water in 48 hours with 5 cc. of the water added.

This standard is not a high one but it is exceptional to find a natural water that will pass all three standards.

Jungle Streams.

From the streams at the higher altitudes the number of organisms in one stream varied from 155 to 205 and another from 115 to 190 per cc. In both the highest determinations were after heavy rain. As the temperature at this time was at night down to 60° F. and there was no cultivated manured

land in the catchment area and in one of the streams no human habitation this compares unfavourably with hill streams of a similar character in temperate climates.

In the water from both streams 5 cc. give a good reaction with MacConkey's medium in 24 hours but not with 2 cc. or 1 cc. No indol forming organisms were found in 5 cc. of either. These waters, therefore, may be considered as fairly good.

Four streams were examined at Ampang. These form the main supplies to the Reservoir. The catchment area, now 1,500 acres, is rigidly preserved. There is no cultivated land in the area and no human habitations or domesticated animals, but there is a certain amount of game. The hills are of granite and thickly covered with trees and jungle.

The streams varied from each other and from time to time and the number of organisms was affected by the rainfall. After long continued dry weather the lowest number was obtained 104 per cc., but after very heavy rain, 2 in. in 12 hours, the number 148 was not much greater. With moderate rains after a spell of dry weather the highest reading 2,120 was obtained.

As regards the four streams in ordinary weather 400 to 800 organisms per cc. were found. Most of the observations were made in June and July by Dr. FINLAYSON and myself. Previous observations had been made in October, 1903, and in January, 1904, with similar results.

With MacConkey's medium acid and gas forming organisms were found to be present in each stream, but the amount of water required to give the reaction varied from time to time. With .1 cc. at one time three of the streams gave the reaction and with .4 cc. the other.

At other times no reaction was obtained with 2 cc. but this was highly exceptional and a positive result was always obtained with 5 cc.

Indol forming organisms were not always present in 5 cc. of the water but were always found in the sediment from the water. Examination of the stream water at the small granite island Pangkor Laut gave very similar results, 300 to 500 organisms were found per cc. Acid and gas forming organisms were present in 1 cc. and Indol forming organisms in 5 cc. No cultivated land, no human habitations and no domesticated animals existed in the catchment area but wild pig were abundant. None of these waters can be considered as satisfactory from the bacteriological point of view.

The Public Health question is a difficult one. The character of the catchment areas in these places renders sewage contamination impossible and the risks therefore of diseases such as Typhoid and Cholera which are conveyed only from man to man by the contamination of the food, water or other injesta with ejecta of persons suffering from these diseases can be definitely excluded.

The existence in nature of classes of organisms closely related to the human intestinal organisms capable of living and multiplying in artificial media at temperatures and in the presence of substances such as bile salt inimical to many natural organisms and which are pathogenic in various degrees to the lower animals, is a matter of great importance.

It is difficult to exclude the possibility that such organisms are agents in the prevalence of intestinal disease amongst persons travelling or working in the jungle.

The history of the occurrence of dysentery amongst the troops engaged in the Bentong Expedition is of interest in this connection.

Dr. Travers informs me "that in the year 1891 a force of some 150 Sikhs and Pathans with coolies and others were camped at Bentong in Pahang for about six weeks. The water for the camp was taken from a river which ran alongside, it was clear bright palatable water. After a few days some 20% of the force was attacked with dysentery some of them being seriously ill. Of eight Europeans four were attacked. On the outbreak of dysentery he at once had wells dug and all the camp had to drink the well water. The result was very satisfactory. The dysentery practically disappeared and with one or two exceptions the men remained healthy. Only a few small Malay Settlements existed in the catchment area and care was taken to get all the water from above the camp."

Such histories are not uncommon in countries thickly covered with jungle where the rainfall is abundant and streams are plentiful. With either small or large parties under such conditions dysentery so frequently breaks out even when no permanent camps are formed and care is taken that no fouling of the watercourses takes place that it is difficult to exclude natural sources of dysentery, apart from human contamination, from consideration.

Ship epidemics and some of the gaol epidemics also go to prove the origin "*de novo*" of some outbreaks of dysentery though no doubt once started human agencies are important factors in the spread of disease.

Of well known organisms common in these waters B. subtilis, B. megaterium, B. violaccous, B. prodigiosus, Sarcina lutea and various Cocci and moulds may be mentioned. They all grew well at blood heat and both B. prodigiosus and violaccous continued to form pigment under that condition. B. pyocyaneus was only found once in any of these waters but does occur in some well waters. Other organisms which we could not identify were common.

Surface Wells.

Examinations have been made immediately after taking the sample of the water from surface wells in the neighbourhood of the Institute. In such the number of organisms is of some importance.

Other examinations are of water from wells collected in various parts of the State. These have been sent by train and delay has occurred sufficient for further development of organisms so that the class of organisms present alone is of importance.

No precautions are taken as regards surface wells beyond making a raised edge some 2 feet 6 inches round the well which prevents frogs, etc., from entering and having the surface of the ground round the well sloped from the well to a drain some 6 feet or less from the edge of the well. This surface is usually concreted. These precautions serve the purpose of preventing water used for bathing, washing utensils, etc., from directly running back into the well. Many of the wells are 24 to 30 feet deep and the surface of the water is rarely less than 6 feet below the ground in dry weather.

The drainage area of such a well is much greater than the small area enclosed in the drain and in dry weather may be so cracked and fissured that water discharged on the surface and containing surface washings may be discharged directly into the subsoil water which supplies the well.

Outside the limited area mentioned but inside the area from which the supply of the well is drawn may be seen native houses with cess pits attached as at Port Dickson, main drains from market places as at Rasa, drains from hospitals, post-mortem rooms, etc., as at Kwala Lumpur, and in practically no case is there a proper sufficient reserve area to prevent occasional or habitual contamination of the well water.

Where wells are necessary, and this is often the case, with sufficient precautions against contamination surface well water is probably better than stream water. No precautions can be sufficient where there is a crowded population and the ground is soaked with human discharges. A certain amount of filtration and purification of the water no doubt occurs and further purification takes place by sedimentation, but I contend that where obvious sources of contamination exist the occasional purity of the water as determined both by bacteriological and chemical methods is no justification of its continued use. Such wells should be closed or the source of contamination removed.

The water from 27 wells in all was examined and of these in only 4 instances could the water have passed as "good" in accordance with the low standard proposed by Dr. FINLAYSON and myself.

In all the others acid and gas forming organisms were present in 2 cc. and usually in 4 cc. of the water, and Indol forming organisms were present in 5 cc. of 10 or more than one-third of the waters examined.

The number of organisms in the wells near the Institute varied from 110 to 1,800, but 350 to 900 were the common limits. *B. pyocyaneus* was found in one instance and in two organisms indistinguishable from *B. coli communis*. No other pathogenic organisms were isolated from these waters, but during an outbreak of Cholera at Rawang vibrios apparently identical with Koch's Comma bacillus were found. Indol and nitrites were rapidly formed in Peptone water and liquefaction of gelatine took place at a rate corresponding to that of that bacillus. It may be mentioned in this connection that the closing of the wells in the Pudu gaol was followed by the disappearance of cholera from that institution and that the closing of the suspected wells at Rawang was followed by a similar result.

In the wells examined most of the commoner non-pathogenic organisms are present and a considerable number of apparently new organisms have been isolated but there is no evidence that they are of any pathogenic or practical importance.

TOWN SUPPLIES.

The water supplies to the larger towns are collected from such streams as those described. The catchment areas are strictly reserved and no settlements are allowed to be made on them.

The water is collected in impounding reservoirs, that at Ampang with a capacity of 37,710,000 gallons for the supply of Kwala Lumpur is at an elevation of 396 feet, and with or without filtration conveyed in pipes to a service reservoir at 1,740,000 gallons in or near the town from which it is distributed as required.

Unfortunately sufficient allowance was not made for the increase in town populations and therefore the works are on too small a scale. The size of the service reservoir necessitates filtration at the maximum speed

during the day and a reduced speed during the night thus testing too severely the working of the filters. The impounding reservoirs in protracted dry weather get too low and any heavy shower in any part of the catchment area may result in stirring up the whole body of water in the reservoir and nullifying the effect of the previous sedimentation.

The Acting State Engineer, Mr. W. E. KENNY, and the Executive Engineer of the Water Works, Mr. J. E. BACH, have kindly supplied me with particulars of the water supply for Kwala Lumpur from which the following figures are taken :—

Catchment Area, 500 acres, an additional 1,000 acres has recently been included.

Capacity of Impounding Reservoir, maximum 37,710,000 gallons.

Capacity of Service Reservoir, 1,740,000 gallons.

Supply daily to Kwala Lumpur, 540,000 to 450,000 gallons.

Average consumption per head per diem 12¼ gallons.

The water from the reservoir taken about 2 feet from the surface is delivered to each filter by a bell-mouthed inlet 2 feet in diameter about 1 ft. 6 in. above the level of the sand. The filter bed is 60 feet below the level of the reservoir and heavy stones are placed round the inlet and above the sand to break the force of the water.

The filter beds are 127 feet by 66 feet at the level of the sand and 7 feet deep from floor to coping.

The filtering material consists from below upwards of :—

(1) A layer of bricks on edge in rows 4⅓ inches apart resting on the concrete floor.

(2) A layer of bricks laid flat about ¼ inch apart.

(3) A layer of broken stone 12 in. deep. The stone at the bottom is broken to gauges of 2⅓ inches and at the top about 1½ inches.

(4) A layer of coarse clean quartz sand 2 feet deep with about 4 inches at the top of rather finer sand.

In long continued dry weather when the flow of water into the reservoir was steady and moderate the effect of subsidence was marked. On two such occasions only 51 and 66 organisms were found per cc. and in the inlet to the filter bed only 24 and 51 respectively. After heavy rain, 2 in. in 12 hours, the whole water in the reservoir was stirred up and muddy and as many as 8,800 organisms were present per cc. These were the two extremes on two other occasions 120 and 150 organisms were present but 300, 400 or 500 with intermittent dry and wet weather when the supply to the reservoir was in excess of the discharge from it were the common results obtained. Four days after the highest number though the rain had been moderate the number of organisms found was still 1,655 per cc.

It is clear therefore that under the climatic conditions present in Malaya small or medium sized reservoirs cannot be relied on to purify the water by subsidence and that the results of storage in such a reservoir will be intermittent as in dry weather water purer than the intake will be obtained but in rainy weather water of worse quality will be discharged than that which enters it.

In MacConkey's medium even when the smallest number of organisms were present a reaction was obtained with 1 cc. of the water but not with .4 cc. No Indol was formed with 5 cc. of the water.

With the largest numbers of organisms 8,800 and 1,655 even in .1 cc acid and gas forming organisms were present and Indol and nitrites were formed with 1 cc. of the water.

On all occasions in 2 cc. acid and gas forming organisms were found but the presence of Indol forming organisms in 5 cc. was not constant.

The filter bed slopes slightly to a small sump at the southern end into a well 7 feet in diameter and 8 feet deep. From this well, the filter well the water is discharged into the main to the service reservoir through a vertical telescopic pipe. The rate of discharge is regulated and the filter head is regulated by the height of this pipe but the inflow to the filter bed can also be regulated. The maximum capacity of the main is 60 cub. feet per minute which corresponds to a filtration rate of 2.71 gallons per square foot per hour and this rate is now constantly maintained from 6 a.m. to 6 p.m.

After scraping the main a discharge of 72 cub. feet per minute with a filtration rate of 3.25 gallons per hour was obtained but this has not been maintained. No such rate of filtration should be allowed. The object of a filter bed is defeated if water is passed through at such rates.

The longest run of any filter bed since Mr. Bach has been in charge was $3\frac{1}{2}$ months. This was during a dry period and no water could be spared to wash the second filter bed. When this filter was emptied the sand was discoloured to a depth of 13 in. Only the remaining some $\frac{1}{2}$ inch of sand appeared to be clean but the stones beneath also appeared to be quite clean.

There is no difficulty whether the filters are clean or dirty in obtaining the maximum discharge that the main can take until the loss of filter head is nearly 3 feet. The depth of water on the sand is regulated by a valve in the intake and it is usually kept at rather over 3 feet.

My first examination of this water was on 29th October after a run of 116 days. At this time the depth of water on the filter was 4.7 in., the filter head 2.8, and the discharge per sq. foot of filter bed 2.05 gallons per hour.

The second examination on the 15th January was made after a run of 27 days, the depth of water on the filter was 3.5 feet, filter head .30, and the discharge 2.71 gallons per square foot.

Table I.

Date.	October 29.			January 15.			June 9.		
Depth of water on sand ...	4.7			3.50			3		
Reservoir Level	...			...			...		
Filter Head	2.8			.3			.55		
Rate of Filtration	2.03			2.71			2.71		
Rain in previous 24 hours ...	...			3.76			Nil.		
Remarks	Run 116 days.			Run 1 month.			Run 47 days.		
	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.
Intake	750	+	+	750	+	+	1,265	+	+ .4cc
Reservoir	266	+	+	3,500	+	+	325	+	+
Inlet to Filter Bed	...	...	...	...	...	...	245	...	...
Filter Well...	209	+	— .5cc.	716	...	— .5cc.	413	+ .5cc.	+ .2cc. .4cc.

The other examinations were made mainly in conjunction with Dr. Finlayson, and details of the conditions which may have affected the working of these filter beds are given separately.

The results of filtration are shown in the subjoined table. The number of organisms in the intake is not for this purpose of much importance as only one or two of the intakes were examined on each occasion.

The water in Reservoir was taken at the same place on each occasion and as a check on this and also as giving a better test of the water actually filtered samples were taken from the water at its entrance to the filter bed. Usually this water gave slightly better results than that taken from the impounding reservoir itself.

	July 6.	July 14.
epth of wa	2.66	2.6
eservoir L	16.5	15
ilter Head	.26	.28
ate of filtr	2.52	1.2
ain in pre	Nil 10 days.	.28
emarks	...	Rate reduced for test purposes for 15 hours.

	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.
Intake	500	+	+ .4cc.	825	+	+ .2cc.
Reservoir	120	...	...	150	—	+ .2cc.
Inlet to Filt	180	+	+ .4cc.	150	—	+ .2cc.
Filter	150	—	+2.5cc — .4cc.	275	—	++ .2cc. + .4cc. — .2cc.

Table II.

Date.	June 9.			June 13.			June 15.			June 20.			June 22.			June 24.			June 28.			July 6.			July 14.		
Depth of water on sand ...	2.32			3.02			3.14			2.62			2.72			2.4			2.62			2.66			2.6		
Reservoir Level	...			...			...			...			...			18			17.5			16.5			15		
Filter Head...	.15			.17			.17			.20			.20			.22			.22			.26			.28		
Rate of filtration	2.6			...			2.6			2.6			1.66			1.44			2 6			2.52			1.2		
Rain in previous 24 hours ...	Nil in previous 48 hours .86			Nil 2 days.			Nil 4 days.			2.58			Nil.			Nil 4 days.			Nil 2 days.			Nil 10 days.			.28		
Remarks	Filter changed 15 hours previously.			...			...			...			Rate of filtration reduced for test purposes.			...			Half rate at night.			...			Rate reduced for test purposes for 15 hours.		
	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.	No. of organisms.	Indol formation.	MacConkey's medium. Acid and gas formation.
Intake	1,265	+	+ .4cc.	250	—	— .2cc.	104	+	+ .4cc.	148	—	+ .4cc.	2,120	+	+ .2cc.	649	—	+ .4cc.	1,496	+	+ .4cc.	500	+	+ .4cc.	825	+	+ .2cc.
Reservoir	325	...	+ .4cc.	55	...	+ .5cc. — .2cc.	66	—	+ .4cc.	8,800	+	+ .4cc.	1,248	+	— .4cc.	1,655	+	+ .4cc.	500	+	...	120	..	.	150	—	+ .2cc.
Inlet to Filter Bed ...	245	...	+ .4cc	24	—	— .2cc.	51	—	+ .4cc.	5,500	+	+ .4cc.	941	+	+ .4cc. .10cc.	—	+	+ .4cc.	577	+	+ .4cc. — .4cc.	180	+	+ .4cc.	150	—	+ .2cc. + .4cc.
Filter	1,290	+	+ .4cc.	230	—	— .1cc. — .2cc.	258	—	— .4cc.	252	—	— .4cc.	73	—	— .5cc. .2cc.	96	—	+ .5cc. — .2cc.	209	—	+ .4cc. — .4cc.	150	—	+2.5cc — .4cc.	275	—	+ .4cc. — .2cc.

Effect of Filtration.

At first sight the results of the filtration are most disappointing as nstead of the reduction of 90 per cent. in the number of organisms obtained by iltration in English and Continental filter beds the number of organisms n the filtrate was actually greater on some occasions than that in the water entering the filter bed.

On closer examination, however, it is seen that when most required and the number of organisms in the reservoir is greatest an enormous reduction is made in the number of organisms. The use of the filter beds prevents the influx of the washings of the streams and render the quality of the water uniform independently of the weather.

Further an examination of the character of organisms in the filtered water shows that nearly all are spore bearing non-pathogenic organisms and that a large proportion are B. subtilis.

As tested by MacConkey's medium the results for some weeks were quite satisfactory as, excluding the examination made after the filter had been in use for 15 hours which of course was too early for bacterial filtration to take place, it was not till the bed had been in use 28 days that the acid and gas forming organisms were numerous and even 8 days later they were reduced in number by the filtration.

Indol forming organisms were not present nor were they at other examinations made of the filtered water 1 month, 7 weeks, and 116 days respectively after the use of the filter bed had been commenced.

The benefical effects of filtration are seen from the table to be :—

(1) The removal for a prolonged period of indol forming organisms.

(2) The removal for a shorter period of a large proportion of the organisms which form acid and gas in MacConkey's medium.

These two classes are those most likely to be dangerous to man.

(3) Equalisation in the number of organisms present and protection of the town supply from the first washings of the ground after heavy rain.

These effects are, in my opinion, quite sufficient to show the necessity of filtration.

The organisms which at first pass through the filter are all spore bearing organisms usually very similar to B. subtilis. In some of the earlier determinations 80 to 90 per cent. of the organisms present in the filtrate were of this class.

In the examinations made after 3 weeks the other organisms were present in constantly increasing numbers so that under the conditions of work of these filters they should only be used for a comparatively short period, not more than a month to get good results.

In Europe and in temperate climates a filter can be run for much longer, but no doubt the higher temperature and greater variety of organisms are factors in the more rapid growth through the filter bed of organisms.

It is important, if possible, to prolong the period of use of a filter bed and also to obtain greater efficiency. It will be noted that filtration has

been effected at such a rate as to give to the maximum supply the mai
is capable of taking about 2.7 gallons per square foot per hour. This is
high rate and though not higher than in use in some waterworks is nearl
twice that recommended as safe in Europe by some authorities and is i
excess of the usual rates.

The effect of a lower rate of filtration is well shown in the result
obtained on June 22 and 24, but when the organisms have grown throug
the bed as on July 14 diminished rate of filtration no longer produces thi
good result.

A constant lower rate of filtration would result in a purer water an
enable the filters to be used longer.

With the present service reservoir and water supply to the town it i
necessary to filter at the maximum rate during the day whilst this rate ha
to be reduced at night by one-third.

Increased filtration area is necessary. An increase in the capacity o
the service reservoir would enable the rate in the day and night to be
equalised but the reduction in the rate would not be sufficient.

How far slower filtration will prolong the life of a filter bed and
whether additional thickness of sand and use of a finer sand on the surface
would improve matters can only be decided by observation of effects
of such changes.

A small experimental filter bed in the vicinity of a laboratory would
enable such experiments to be made and lead to more economical and
efficient work.

The water supply as distributed to the town has been tested at a few
stand pipes only. Some of the results correspond closely to those obtained
from the water at the service reservoir, but in others much greater
differences are observed and the variations are not constant and depend
apparently on local and temporary circumstances.

The more thickly populated part of the town is well supplied with
water but large areas including all the places where cattle are kept are
dependent on other sources and surface wells are still extensively used.

Klang Waterworks.

The Klang waterworks provide unfiltered water to a population of
some 5,000 people and it is also the intention to supply the shipping at
Port Swettenham as well as the township there.

The impounding reservoir is a natural valley of varying depth dammed
up at the lower end. Some parts are quite shallow. The capacity is given
as 3,928,984 gallons and the catchment area to supply this reservoir is
340 acres.

The rainfall is less than on the Ampang catchment area and the
ground more porous so that much of the lighter rain sinks into the ground.
For storage during a spell of dry weather broken only by light showers
this reservoir has proved to be insufficient.

The water from this impounding reservoir is conveyed by pipes, some
8 miles, to a service reservoir with a capacity of 563,284 gallons. From
this service reservoir the town of Klang is supplied and also a large tank
of 26,475 gallons which serves for the supply to Port Swettenham.

The water is not filtered and examination of the water in the service
reservoir at Klang shows that acid and gas forming organisms were present

1 .2, .5, 2 and 5 cc., and Indol forming organisms in 2 cc. and 5 cc. of he water. The amount of purification by sedimentation is, therefore, insufficient, and the water cannot be considered as good.

The examinations were made during a period when there were light ains only and so under favourable conditions. With heavy rains the water n the shallow impounding reservoir is stirred up and much worse results vould no doubt be obtained.

Amount of Water.

The water supplied is equivalent to 12½ gallons per head of the population of Kwala Lumpur, but as water is used by the railway, is used for flushing public latrines and occasionally for watering the roads the actual amount supplied per head is much less.

In addition to drinking water much water is rightly used for bathing by all races especially by the Chinese and Malays. The allowance of water is, therefore, very small. A minimum of 20 gallons per diem would be too little.

Even if this minimum is taken as a standard the amount required for Kwala Lumpur exclusive of that required for the railway, etc., would be about 740,000 gallons per diem and for Klang, exclusive of the supply to steamers, railway, etc., about 100,000 per diem.

This corresponds to rather more than 2 and 4 days supply respectively from the service reservoirs and is in great excess of that supplied by the main which in Kwala Lumpur can only supply 550,000 gallons per diem.

It will be apparent from the above that increased and improved water supply for the larger towns is necessary even with the present population. Exclusive of any calculations based on a possible increase in the population the following alterations are necessary :—

(1) Increased or extra impounding reservoirs. The increase need not necessarily be in the same situation as at a lower elevation the greater part of the town could be easily supplied.

(2) Increase storage in proximity to the town. The present site of the reservoir is ideal but for the town and railway a service reservoir at a lower elevation would suffice.

(3) Increase in the filter area. The present rate of filtration is too high and no increased rate could be tolerated. Additional filter beds are urgently required. In case the present inadequate water supply be reserved for the higher parts only of the town and a supplementary water supply is established at a lower level the additional filter beds should be in connection with the new supply. The rate should never exceed 1½ gallons per square foot of filter bed per hour. Far worse water than that in the Gombak River, the Klang or other rivers if passed through *efficient* filter beds proves quite satisfactory in other countries. There is no reason why with such modifications as are found requisite impure waters such as these should not be efficiently treated by filtration.

The modifications required must be decided on by the results of future work but will probably include greater depth of sand, finer quality of sand for the surface of the bed and slower rate of filtration.

Observations and experiments elsewhere are valuable guides to th observations and experiments required here, but it cannot be too strongl insisted on that the *results* of such observations elsewhere cannot be take as guides to practical working here. The local conditions are differen and it is only by the results of local determinations that complicated system can be adapted to meet the local circumstances.

The effect of the water supply on the occurrence of disease cannot b determined at present. The areas of the town where other waters are use are so extensive that the general rate of intestinal disease cannot be fairly attributed to town water.

The occurrence of Typhoid amongst Europeans who drink exclusively town water is possibly due to the contaminated water used for the fraudulent dilution of milk and cannot be fairly attributed to the town water.

The gaol is supplied only by town water but this is boiled before use so that the freedom of the occupants of that institution from intestinal disease cannot be attributed entirely to the purity of the water.

Analyses have shown that chemically the water is very pure and free from the chemical products of the decay of animal or vegetable matter. In this it differs from the Singapore waters which contain a considerable amount of Albumenoid Ammonia.

The absence of smell and taste in the Ampang and Klang waters is probably to be attributed to this purity and the slower rate at which organisms grow through the filter bed as compared with Singapore, is perhaps due to the same cause.

PART III.

PREFACE.

While the *Notes* on the *Culicidæ of Malaya* were in the press the fourth volume of THEOBALD'S *Monograph of the Culicidæ of the World* was published, and some of the species here described will be found under other generic and specific names than those given, and such names will of course have to stand. The *Notes* had already been almost re-written to bring the classification up to date when the third volume of Mr. THEOBALD'S work appeared, and it was not deemed advisable at so late a period to delay these *Notes* while necessary alterations in classification were made. An Appendix will be published later with a résumé of the classification together with the new names for all species described in the work referred to. The larval characters are not given as it is hoped to issue a short description of these in a separate work.

Breeding Grounds of Culicidæ.

By C. W. Daniels, M.B., M.R.C.S.

In Malay these diptera are characterised rather by the number of enera and species than by number of individuals.

From the detailed account by Dr. Leicester it will be seen that large number both of the genera and species are new or have not been escribed before. This in part is due to the discovery of new breeding laces and also to the closer attention paid to certain known breeding rounds in which the number of individuals is usually small and therefore he larvæ are difficult to detect.

Although some of the new species can be accounted for in this manner, nany of them have been found so readily and in the course of so ordinary n examination that it is clear that to a large extent the Culicidæ of Malaya re peculiar.

Some of the species represented are widely distributed, and in the owns the world wide *Culex fatigans*, is well represented. *Stegomyia fasciata* is ound in some of the coast settlements and both in these and throughout the ountry *Stegomyia scutellaris* which also occurs throughout Asia and Africa is bundant. Of the *Anophelina Myzomyia Rossii* the universal Asiatic species s well represented. *Myzorhynchus Sinensis* is the common anopheles of Eastern Asia, and *Myzorhynchus Barbirostris* with its sub-species are ommon.

Cellia Kochii so far only described in Malaya and the Malay Archipelago s under some circumstances prevalent. *Nyssorhyncus Nivipes*, *Anopheles Treacherii*, *Myzomyia Albirostris* and *Lophoscelomyia Asiaticus* are, as far as we now, limited to the Malay Peninsula, but more extensive examinations of bamboos will probably show that the last has a wider distribution.

There is not a single American, European or African species of the Anophelina found in this country. Of the Indian species only those found n or near towns are represented, the jungle and stream species are, with the exceptions of Karwari and Willmori, quite distinct in the two countries. Of the Mansonia, *M. uniformis*, so widely distributed throughout the old world tropics, Asia and Africa, is far less common than in Africa. *M. annulipes* is a sylvan species peculiar to this part of the world. Desvoidya s well represented by species of which three have so far been found in Malaya.

Of the mosquitoes found in small numbers *Culex maculicrura* is found also in Africa and Queensland, and it is singular that the specimens of what s considered as an African genus, *Mucidus*, have been found on one occasion only here by Dr. Liecester, and that the specimens are apparently dentical with the *Mucidus Mucidus* of Central Africa.

Breeding Grounds.—Some of the thicker-shelled eggs such as those of Stegomyia, Desvoidea, Wyeomyia, etc., can withstand protracted drought. Larvæ vary, but many are capable of maintaining life in moist mud or thick slime for a limited period, but for the hatching of eggs, growth and development of larvæ and pupæ of all mosquitoes, water is essential.

Some larvæ can develope in almost any water if provided with plentiful food supply, but these are exceptions. A degree of stagnation or putridity is soon reached with most larvæ, and many can only live in water that is clear, free from smell and not loaded with vegetable matter.

Many of the species have well defined habitats and are only found in these. Others, though preferentially with special breeding places, are found exceptionally or in very small numbers elsewhere. Instances of these will be given as we proceed.

In the dry though not rainless seasons many species are only found in small numbers.

Of the mosquitoes with selective breeding grounds in nature some are not found elsewhere. The reason for this selectiveness is not apparent, as the larvæ under various artificial conditions thrive and mature. Most of the larvæ found in bamboos and pitcher plants can be reared in the laboratory though development is usually slow.

The length of time required for the development of larvæ varies greatly. The great retarding influence in Europe either in the hatching of ova, the development of larvæ or the transmutation of pupæ is cold. With the uniform temperature in this climate this factor may be ignored and sufficient suitable food is the most important condition, but any change from the normal habitat appears to cause delay. Larvæ which develope rapidly at first in the water in which they were found although supplied with similar water containing abundant organic matter have taken in the laboratory over three months for pupation.

The circumstances affecting the transmutation of the pupa appear here to be few.

The longest period is that taken by the Megarrhines, Toxorhynchites and Kolonemyia, 6 to 7 days. With other mosquitoes 2 or more days are the usual periods.

Adult mosquitoes require at the ordinary temperature of the country abundant food supply or die rapidly without depositing eggs, many species cannot be induced to feed in captivity.

Another important factor with some mosquitoes is the humidity of the air. The purely jungle species and many of the ædomyina die in an hour or two in a dry atmosphere. In well cleared spaces even of a few acres such mosquitoes are rarely found as during dry periods of the day they will be killed off.

The heavy mortality amongst men in any operations involving residence in crowded bangsals in thick jungle where there is a heavy rainfall is probably due to the persistently moist atmosphere in which the jungle stream breeding *Anopheles Treacherii* is found.

The natural breeding places of larvæ can be conveniently subdivided into permanent and temporary. The permanent are increased in area and extent in the wet season whilst the temporary become of importance only when rainless periods are short or for a period after heavy rains. This varies with the depth of the holes, the porosity of the soil, and the humidity of the atmosphere.

Amongst permanent breeding places are streams. These vary in character: —

(*a.*) In the rapid mountain streams, particularly in the clear streams in the granite formation, few, but important, species are found. These include *A. Treacherii and Nyssorhyncus Willmori.*

(*b.*) More sluggish streams found in the lower more gradual slopes of the mountains and from springs arising in these slopes.

In these the water is often muddy and contains much organic matter n suspension. Such streams where there is any obstruction or where a at piece of land is traversed form swampy expansions. In such streams nd expansions the mosquitoes vary in open country and in jungle.

In jungle *A. Treacherii*, *N. Willmori*, and *N. Karwari*, are common, rarely *I. leucophyrus*.

Various Uranotænia Culicina, etc., are found in such streams or their xpansions.

In open country *Myzorhynchus barbirostris*, *M. albirostris*, and *Cellia Kochii*, re more commonly found.

Very similar mosquitoes are found in open trenches supplied in part y streams at the road sides and leading to padi fields, etc. Some f these *Uranotænia Campestris*, some members of the genus *Melanoconion* and *Conotiomyia* are only found in such places.

In the rivers few larvæ are found. This is in marked contrast with Central and East Africa where the rivers are the main breeding grounds. The comparative scarcity of reeds and grasses with submerged roots may have something to do with this, and the fouling of practically all the rivers with tailings from mines may also be an element. Where the rivers expand nto mangrove swamps a new series of mosquitoes are found which breed readily in these expansions.

The larger masses of water which are permanent are small natural akes and artificial pools left from mining or brickmaking. Further artificial collections are made by damming up streams either to or from artificial collections or to divert such streams for mining purposes.

In such larger masses of water the mosquitoes found, vary with the nature of the bank. With clean steep banks and no growth at the edges mosquito larvæ are not found, e.g., Ampang Reservoir. With shallow sloping banks with growth to and beyond the water edges as Lake Sydney, various collections of water as at Seremban, etc., many mosquito larvæ are found.

Of the Anophelina *M. albirostris*, *M. barbirostris*, *Nivipes Cellia Kochii*, and *M. Karwari*, various Culiciia such as Tæniorhyncus Ayer and Tenax Melanoconion variatus and tærriata are also often present. They are found either with difficulty or in varying numbers, even when fish are present.

In the artificial swampy areas in which rice is grown, most of the same species are found, and also *M. Rossii* in some instances.

In water much fouled with mud or fine silt, such as swamps in mining land, *M. Rossii* is often the only representative of the Anophelines, but *Cellia Kochii* sometimes is present in large numbers.

In other collections, determined in part by the proximity of human dwellings, cattlesheds, etc., different species may occur, and it is unsafe by mere inspection of such collections to predict the larvæ that will be found.

Smaller collections of water not in continuity with streams, but in low-lying land near streams or where the level of the subsoil water is high either permanently or for prolonged periods yield great variety of larvæ.

Holes in impervious material such as granite, may contain water f prolonged periods. This is especially the case in holes in granite boulde in a river bed when shaded by jungle. In one such hole on several occasio at Ulu Gombak, larvæ were found which have been found in no other pla Other larvæ in such pools are certain species of Melanoconion, Desvoid Culex, and particularly *Culex gelidus*, and at Pangkor Laut Dr. CLARE found repeatedly larvæ of a species of anopheline in holes in such boulde near the sea.

An important class of permanent breeding grounds are formed b various plants.

The most important of those in Malaya is that discovered b Dr. LEICESTER—the Bamboo—("*Journal of Tropical Medicine*," Sept. 1 1903).

In this situation a large series of mosquitoes were found breeding a nowhere else. Bamboo breeding places are of two classes:—

(1) *Growing bamboos.* In joints perforated by a borer at one more places and containing water.

(2) Cut or broken bamboos in which the upper or opened joi contains water or in fallen split bamboos containing water.

The number of species found in the perforated bamboo is not so gre as in the cut bamboo, and species which are rare in the one are common the other.

In perforated bamboos the usual larvæ are:—

Orthopodomyia albipes; Skeiromyia fuscus; Dendromyia communis Megarhinus magnificus, raris and *quasiferox; Toxorhynchites metallicus Lophoscelomyia asiatica*, and *Kolonemyia cæruleocephala.*

In cut bamboos the commonest are:—

Stegomyia scutellaris, perplexa, gracilis, fasciata and *nivea; Scut myia albolineata; Hulecœtomyia trilineata* and *jugrænsis; Daniels albotæniata; Uranotænia lutescens; Leicesteria dolicocephala, cingulat annulitarsis* and *longipalpis; Desvoidea obturbans* and *jugrænsis; M garhinus quasiferox* and *funereus; Toxorhynchites leicesterii* and *metallicus Orthopodomyia albipes; Lophoscelomyia asiatica;* and *Myzomyia leucophyrus*

Of these Stegomyia and Desvoidea are found also elsewhere quit commonly, and *Myzomyia leucophyrus* is found more commonly in othe places.

Many larvæ in both the perforated and cut bamboos have not bee reared and probably belong to other species of the genera represente Adults of such species have been found in the neighbourhood of bambo clumps and they have not been found breeding elsewhere.

The importance of bamboos varies in different places.

Bamboos are rare in some places and are not found in some of th smaller islands. In such places some species of the above mentioned gener may be found, but rarely in hollows of trees, empty cocoanut shells, etc., i such situation *Meg. quasiferox* and *Toxorhynchites metallicus* and an *Ortho podomyia* have been found. In other places, as in cultivated bamboos, n borers are found, and the number of bamboos attacked by borers or other wise allowing access of mosquitoes to the interior varies greatly. In som places, *e.g.*, Jugra and the Gap, as reported by Dr. LEICESTER, the perforate bamboos are unimportant as breeding places.

This variation in the importance of bamboos is dependent not only on ıeir number but on the number bored. The only bamboo borer reared ·as a longicorn bettle, species undetermined. It is probable that various oleopterous borers are concerned, and on the existence of suitable species ı a locality the prevalence of bamboo breeding mosquitoes is dependent. Ir. RIDLEY has pointed out that the species of bamboo is of much nportance in this connection, as some species are rarely if ever attacked y borers. These species include the imported bamboos growing near the oast or cultivated, such as *Dendrocalamus flagellifer*, from Burmah, *Bambusa ·algaris*, from China. Of the species attacked by borer near Kwala Lumpur)endrocalamus *pendulus* and a *Schizostachyum* species (?) appear to be the ıost common. Both these are indigenous species. Some of the other ıdigenous species do not appear to be attacked in the same neighbourhood.

Another class of plants in which mosquito larvæ are commonly found re the Pitcher Plants, *Nepenthes*. The plants are rare in many parts of the ·ederated Malay States.

This breeding place was first pointed out by RIDLEY in 1896 in the *Journal of the Asiatic Society*."

Collections of larvæ have been made by FINLAYSON and identified by LEICESTER as *Uranotænia lutescens*, *Sheiromyia fusca*, *Megarhinus acaudata*, *Stegomyia sintillaris*, etc., similar to the class found in bamboos.

Near the coast larvæ are found in the water in the Nipah Palm, *Nipa rutieus*, and amongst these *Stegonyia fuscius* is not found elsewhere.

Another breeding place reported by MILNE is the Traveller's Palm, *Ravenala Madagascariinsis*, but the species of mosquitoes were not identified.

Other permanent collections of water are cess pits, tanks, Chinese jars,)ath tubs, kerosine tins, etc.

These are artificial and are found in the neighbourhood of inhabited)laces. The number of individual mosquitoes rather than the variety of ·pecies is the characteristic of such breeding places. *Culex fatigans*, which s not met with elsewhere, abounds in the neighbourhood of such breeding)laces, and the number of *S. scutellaris* is much increased. In collections)f leaves in the jungle certain special species may be found. These :ollections, in damp places, are sufficiently permanent to serve as breeding ;rounds.

INFLUENCE OF HUMAN HABITATION.

Human occupation makes a great difference not only by the alterations, ısually for the worse, in subsoil drainage and in provision of artificial per- nanent and temporary breeding grounds, but also by providing adults with ın abundant stimulating food supply and good suitable shelter.

Under such circumstances the number of mosquitoes found is much ncreased.

With a small group of houses in jungle at first there is little or no lifference. Many of the jungle mosquitoes are day feeders and appear to ıvoid the cleared spaces. They may be numerous and yet none be found n the houses.

Cutting down bamboos and so leaving a large number of open joints :ontaining water increases the number of easily available breeding places, ınd the refuse, empty tins, half cocoanut shells, etc., form a most suitable)reeding place for hardy jungle mosquitoes such as *Stegomyia scutellaris*.

The number of these larvæ in close proximity to a house may be great, an yet the number of adults that enter the houses very small. It is not ti clearings become larger that such mosquitoes become truly domesticate In the larger clearings such as the smaller township or suburbs with littl or no jungle close to the houses these mosquitoes are found in abundanc in the houses and breed in water such as in water jugs or bath tubs in a well as outside the houses. *Stegomyia scutellaris* is therefore capable c domestication and under such circumstances may be found in large number

Many other of the jungle mosquitoes are found from time to time i houses and bite freely, but do not appear to become domesticated or to bree in the houses, e.g., *Leicesteria*. To these may be added the widely distribute country mosquito, which is not restricted to jungle districts, *Mansoni uniformis*.

The mosquito which is most persistently met with in houses and rarel found away from them is *Culex fatigans*. In the jungle it is not found, no as a rule in small clearings in jungle, but as soon as a small village is forme it appears and becomes very numerous, breeding freely in almost an stagnant water, and particularly in water, however foul, contained in jars c other artificial vessels. *Anopheles Rossii*, *Kochii*, and *Barbirostris*, are rarel found at any distance from human settlements.

Towns.

The mosquitoes prevalent in a town such as Kwala Lumpur vary i each part. In all *Culex fatigans* is found, but it is in the crowded parts an particularly near Chinese quarters that it becomes a real pest. In th purely European part where houses are at some distance from each other, i care be taken about drains, storage of water, etc., the number of mosquitoe found will be small, but, however great care is taken, these and the hardie jungle mosquitoes will from time to time be found.

Coast Lands.

Proximity to the coast is a cause of much greater difference tha altitude. Mosquitoes are found there which are found nowhere else, an many of the common inland species are absent.

Observations were made at Port Swettenham and the low-lyin mangrove swamps around it; at Jugra, where the coast lands are partly o the same character, but with a granite hill 915 ft. high close to it; nea Port Dickson, where there is a clean sandy beach and the land behind i well drained and elevated; and at an island, Pangkor Laut, which is a granite formation with rocky edges and small stretches of sandy beach.

At Pangkor Laut the mosquitoes found were similar to those met wit inland granite formation. No new species were found. There were n bamboos, but in a hollow in a tree trunk Toxorhynchites metallicus an species of Orthopodomyia differing only in colouring of last tarsal joints o the hind legs from that common in bamboo was found.

A. Treacherii was found in the streams on the side of the steep hills o this island and was also found in the granite hills behind Jugra, but not i the flat coast lands, so that the unhealthiness of most of the coast district cannot be attributed to this mosquito.

In hollows and holes in granite boulders various species of mosquitoe were found, including, according to Dr. Clark, one species of anopheles.

The most important differences were to be observed in the portions of the coast near Port Swettenham where the land is low and swampy and covered with mangrove.

In Port Swettenham itself, *Stegomyia fasciata*, the mosquito which has been shown to carry yellow fever, was found in the houses and breeding in or near them.

This mosquito occurs at Singapore, but was not found at the other places examined on the coast, nor does it occur inland. It is probably an introduced species as it is easily carried in ships either in the adult form as larvæ, or as eggs.

The distribution of the mosquitoes along this part of the coast was specially investigated by Dr. Leicester, who reports as follows:—

Report of an Investigation of the Mosquitoes of Port Swettenham, Klang and Jugra.

By G. F. Liecester, M.B., C.M., Edin.

The investigation was spread over a period of 24 days from 21st December, 1903, to 15th January, 1904.

Port Swettenham.—This town is built on land which was formerly a mangrove swamp all of which at one time was under tidal influence. An area of rather over 100 acres has, however, been entirely reclaimed and is now protected by bunds from such influence. Part of the town is still without the bunded area and therefore still liable to flooding during the highest tides. This is an important fact, as all pools in the mangrove swamps surrounding the town are at least once a fortnight flooded with saline water. A sample taken from one of these pools about 150 yards from the mouth of the creek up which the water supplying them flows had a salinity of 1.618 grams per litre.

On the south-east is felled mangrove swamp extending from the bund to the Sungei Aur, a tributary of the Langat River, with large pools fed by small creeks into which the river flows at high tide. In the north-west is mangrove swamp stretching down to the Klang River, and on the south-west the town is bounded by the Langat River. Running right through the bunded area is the Kwala Klang Road, which acts as a sort of dividing line for the whole, being the highest point within it, and from either side of this road the rain water in part drains off to the outlets in the bunds, and it is here that during heavy rainfalls water is found lying in sufficient quantity for mosquitoes to breed in. There is also considerable retention of water in the dotted area marked "A" in the map.

The soil consists of soft mud charged with organic matter lying upon a bluish clay.

Rain fell on the last two days. But little fell during my visit. Under half an inch fell on the first two days.

The following mosquitoes were caught:—

(*a.*) In houses:—

Culicina.

Culex fatigans	... ...	Numerous.
Stegomyia fasciata	... ...	Scarce.
Do. scutellaris	... ...	do.

Anophelina.

Myzomyia Rossii	... ...	Numerous.

(*b.*) In Jungle :—
Culicina.
Stegomyia fuscus ... ... Scarce.
Grabhamia dubitans ... ... Fairly Numerous.
Tæniorhyncus conopas ... ... Scarce.

(*c.*) In crab holes :—
Aedina.
Verallina Butleri ... ... Numerous.
Uranotænia cancer ... ... do.
Ficalbia longirostris ... ... Scarce.

Larvæ of the following mosquitoes were taken :—

(*a.*) Within the bunded area and in small mud holes :—
Anophelina.
Myzomyia Rossii.
Cellia Kochii.

(*b.*) In tubs, old tins, and other artificial collections of water :—
Culicina.
Culex fatigans.
Stegomyia fasciata.
Do. scutellaris.

(*c.*) In clean water such as disused wells and swampy ground :—
Culicina.
Tæniorhyncus tenax.
Culex maculicrura.
Anophelina.
Myzorhyncus sinensis.
Cellia Kochii.
Aedina.
Uranotænia cancer.
Ficalbia longirostris.

(*a.*) Without the bunded area and in fresh pools :—
Anophelina.
Myzomyia Rossii.
Culicina.
Culex maculicrura.

(*b.*) In pools flooded at high tides :—
Anophelina.
Myzorhyncus Albotæniatus.
Aedina.
Verallina Butleri.
Uranotænia cancer.

(*c.*) In water collected in the bases of the leaves of the Nipah Palms :—
Culicina.
Stegomyia fuscus.

The only house mosquito during the day was Stegomyia fasciata. A marked contrast to Kwala Lumpur where this mosquito is unknown. The evening mosquitoes were Culex fatigans and Tæniorhyncus dubitans. The commonest jungle mosquito is Verallina Butleri. This mosquito exists in enormous numbers in every part of the mangrove jungle and is taken

so in the cleared ground wherever there is long grass or undergrowth to ford it harbourage. Its larvæ and that of Myzorhyncus Albotæniatus e amongst those mosquito larvæ capable of living and growing in ackish water.

Klang.—The town of Klang, situated on the river of that name, is ounded on the north by the river, on the west and south by a range of nall hills, clad for the most part with jungle, and on the east by flat land xtending down to the river. The river is tidal and the greater part of the own is but little above the level of its banks. The hills are spurs running ut from the end of a long range which stretches away in a southerly irection for about 5 miles along the Langat Road when the land again ecomes flat and swampy. More westerly the land is flat right away to the ast. At the foot of the hills, as the map shews, the ground water is high nd the land here is permanently swampy. The ground on either side of ne railway is always more or less swampy, and in places the water lying ere is covered with floating weed. The hills, except where they have been leared, are covered with ordinary jungle. The land in the open spaces of ne town has all been cleared, but in places it is now covered with low ndergrowth, which Dr. WATSON tells me is of about a years growth.

Nature of the soil varies considerably. Near the river on the lower nds it consists of a covering of organic detritus lying on a bed of clay. On the hills the upper soil is red earth and in the jungle this is covered vith decaying vegetable detritus. On the sides of the hill there is a vein f red sand. Doubtless the clay substratum tends to maintain the ground n a swampy condition. During the time spent at Klang rain fell at ntervals of 3 days for about 3 successive days at a time. The average laily rainfall was less than half an inch spread over about 8 days, the eaviest daily fall being 2.89 inches, the lightest ·01. Most of the rain fell n the afternoon.

(*a*.) The following mosquitoes were caught in houses:—

Anophelina.
Myzomyia Rossii
Cellia Kochii
Myzorhyncus Kawari

Culicina.
Culex fatigans.
Do. Maculicrura.
Grabhamia dubitans.
Stegomyia fasciata.
Do. scutellaris.
Deovoidea obturbans.
Mansonia uniformis.
Do. annulipes.
Melanoconion variatus.

Aedina.
Uranotænia cancer.
Do. campestris.

(*b*.) In Jungle:—

Anophelina.
Myzorhyncus umbrosus.
Do. sinensis.

Culicina.
Culex maculicrura.
Melanoconion tæniata.
Mansonia annulipes.
Tæniorhyncus brevicellulus.
Desvoidea jugrænris.
Chætomyia longipalpis.
Aedina.
Howardina varietas.
Verallina Butleri.

(*c.*) In open spaces amongst low undergrowth :—
Culicina.
Culex maculicrura.
Do. gelidus.
Melanoconion tæniata.
Tæniorhyncus brevicellulus.
Aedina.
Verallina Butleri.

The larvæ of the following mosquitoes were taken :—

(*a.*) In mud holes, i.e., small holes made by the foot of a heav animal or a waggon rut in a road :—
Anophelina.
Myzomyia Rossii.
Cellia Kochii.

(*b.*) In stagnant shallow water supplied by rain and liable to dr up :—
Anophelina.
Cellia Kochii.
Culicina.
Ekrinomyia auromaculata.
Culex gelidus.
Tæniorhyncus tenax.
Melanoconion rubithorax.
Aedina.
Uranotænia cancer.

(*c.*) In swamps :—
Anophelina.
Myzorhyncus barbirostris.
Do. sinensis.
Do. umbrosus.
Cellia Kochii.

(*d.*) In marshy ground fed by a stream :—
Anophelina.
Cellia Kochii.
Nyssorhyncus nivipes.

The jungle on the hill range running parallel with the Langat Road was entered at several points to ascertain what mosquitoes were common there. On the first occasion Myzorhyncus (anopheles) barbirostris and Mansonia annulipes were obtained in very large numbers during the day, but on the hill marked "M" in the map, no anopheles were obtained in the

vening though they were abundant in the day. Later on the jungle was visited on two other occasions and the numbers of anopheles present had considerably diminished. There is evidence that a great seasonal variation in the number of anopheles present in this jungle occurs, as on an unknown date last year, Mr. CAREY observed anopheles in great numbers in the jungle at about the 3rd mile on the Langat Road, and on a later occasion he, with Dr. WATSON, visited this jungle, and they were unable to find a single anopheles. I am at present unable to offer any explanation of the above facts. The disappearance of the mosquitoes does not seem to have any relation to the rainfall, nor should I expect this, as the swamps at the foot of these hills where larvæ were found are permanent, and therefore the breeding places would not dry up during the dry season. More extended observation may give the clue at present lacking. It is to be noted that species of what are probably the more dangerous genera of Anophelina, such as Nyssorhyncus Willmori and Nivipes, only breed in such swamps as are fed by springs or streams and not in the more stagnant swamps or artificial collections of water. Cellia (Anopheles) Kochii may prove an exception to this rule.

Jugra.—Two days only were spent here.

The town is situated at the base of a solitary hill of about 1,000 feet high and on the Langat River. This hill rises like a solitary cone from the surrounding mangrove swamp which surrounds its base on all sides. On the north and west the river Langat winds through this flat land to its mouth. The mangrove swamp is under tidal influence.

The hill which is apparently composed in part of granite was originally entirely clad with jungle, but small areas have been cleared and are now clad with lalang. The jungle is for the most part composed of large trees, but on one side of the hill there are a few clumps of bamboos. The underground water is high and numerous springs keep the ground wet and marshy. In the jungle there are one or two hillside streams running over a rocky bed and merging here and there into silent pools and at the foot of the hill spreading out and forming swampy areas of considerable extent.

Soil.—In the mangrove swamps the soil consists of a subsoil of clay covered with a layer of mud consisting of organic debris. On the hill the soil is largely composed of decaying vegetable matter.

Rainfall.—Rain had fallen in quantity two days before I reached Jugra, but none fell during my stay there.

The following mosquitoes were caught :—

(*a.*) In houses :—

Culicina.

Mansonia annulipes.
Culex fatigans.

(*b.*) In jungle :—

Anophelina.

Myzorhyncus barbriostris.

Culicina.

Mansonia annulipes.

Aedina.

Verallina Butleri.
Zeugnomyia gracilis.

(*c.*) In mangrove :—

Aedina.

Verallina Butleri.

Culicina.

Mansonia annulipes.

The larvæ of the following mosquitoes were found :—

(*a.*) In jungle streams :—

Anophelina.

Anopheles Treacherii.

Myzomyia leucophyrus.

(*b.*) In marshy ground fed by springs or streams :—

Anophelina.

Nyssorhyncus Willmori.

(*c.*) In small stagnant collections of water :—

Anophelina.

Cellia Kochii.

Culicina.

Desvoidea jugrænsis.

Culex maculicrara.

Do. fatigans.

Jugra presents features of great interest from the point of view of the distribution of certain mosquitoes. Anopheles Treacherii has been found at Ampang near the reservoir in a hill stream at the 6th mile on the Pahang Road, and at Ulu Gombak and Bukit Kutu. It is essentially a hill stream breeder and its presence at Jugra is worthy of note when one considers how small is the area of the hill and how isolated its position being surrounded for miles by dead level swamp land where it is fairly certain no Treacherii are to be found. Nyssorhyncus Willmori is evidently a fairly common mosquito and may be shown to be of great importance as it belongs to a geneus some members of which are known to be good carriers of the Malarial parasite. Though my data are too meagre to enable me to speak with certainty it is possible Anopheles Treacherii will only prove a source of danger to man residing in or in very close proximity to jungle. It is unlikely it can exist except in a very moist atmosphere and it is of very weak flight and therefore probably unable to travel against a breeze. It is evidently very selective in its breeding places and though widely distributed its presence in any one place may be circumscribed as at Jugra. The absence of all bamboo breeders is another point to note. There are a few clumps of bamboos on one side of the hill but in none of those examined could I find the usual perforations made by the larvae of some insect which is commonly seen in the bamboos in the neighbourhood of Kwala Lumpur, and for this reason none contained water.

It will be noted from this report by Dr. LEICESTER how markedly the species vary in the drained or bunded areas even when, as is often the case, the number of individual mosquitoes, especially of certain species, as *Culex fatigans*, *Stegomyia scutellaris*, and *Myzomyia Rossii*, may be much increased.

It will, however, be observed that occasionally mosquitoes belonging to ıe surrounding undrained district were found in the houses, though none f their breeding grounds were found near these houses.

The occasional presence, in the absence of bamboos, of some of the ›amboo breeders at points on the coast has been alluded to.

As regards crab holes it is noteworthy that, though a favourite haunt f certain species rarely found elsewhere, the members of the genus)einocerites, specially associated with Crab Holes in the West Indies, were ıot found here.

Influence of Altitude.

Observations were made at several points on the coast, in the neigh-›ourhood of Kwala Lumpur and in several places in the jungle at distances ıp to 16 miles from it. At higher levels Bukit Kutu 3,400 feet and on both ›ides of the dividing ranges between Selangor and Pahang.

A large number of species were common to all altitudes and appear lependent rather on suitability of breeding grounds than on the altitude or varying temperature. Other mosquitoes are rare at the higher altitude, but :ommon on the plains and vice versa.

Stegomyia scutellaris, *Desvoidea fuscus* and *obturbans*, all the com-moner bamboo breeding mosquitoes, *Megarhinus*, *Toxorhynchites*, *Kolonemyia*, *Orthopodomyia Wyeomyina*, as well as the stream breeding *Anopheles Treacherii*, all occur where conditions are suitable as abundantly as at lower levels and more so with most species of Kolonomyia. On the dividing range at the Gap, 2,700 feet above the sea level, Dr. Leicester found several species of a new genus. *Topomyia* probably a stream breeder. No species of this genus occur in the plains nor at the same elevation in the hills at Bukit Kutu.

Nature of the Ground.—Most of the hills and mountains are of granitic formation and composed of masses and boulders in various stages of decom-position superficially. The streams and collections of water in such hills are those considered.

In the lower hills, clay and laterite are the main constituents and though in streams in such ground certain mosquitoes such as *A. Treachrii* are comparatively rare, in other respects conditions are similar, and similar mosquitoes are found.

In some places there are hills composed of limestone much metamor-phosed. In such hills, streams are very rare. The ground is porous and the only collections of water are in the caves and deep holes in the rock. In these *Stegomyia scutellaris* larvæ abound. In the jungle in the isolated limestone masses in the Kinta valley *Stegomyia scutellaris* and *Culex biauratus* were the only mosquitoes found.

Cleared Land.—In large cleared areas such as that formed by the groups of mines in the Kinta District, the number of mosquitoes is only excessive in villages and towns. In such places *Culex fatigans* is, as in other towns, the prevalent mosquito, but *Stegomyia scutellaris* and *Myzomyia Rossii* are also abundant.

In the swamps, pools and streams, the water is usually more or less turbid from the finer "tailings" discharged in the mining operations.

In such places *M. Rossii* and *Cellia Kochii* are often abundant, and amongst other common mosquitoes are *Culex nigrocephala*, *Culex gelidus*, etc.

In the paddy fields the same mosquitoes are found, and in additio sometimes *N. nivipes*.

Stegomyia scutellaris may be found in the pools, but is more common i artificial receptacles. Practically no jungle was left, but low undergrowth grasses and sedges are common.

Certain mosquitoes which are often met with in smaller cleared area in jungle country in Malaya were not found. These include several specie of Melanoconion, *M. albirostris* and *Culex mimeticus*.

In conclusion, as regards the diminution in the number of mosquitoe in any place it is obvious that the measures to be adopted will depend o the species of mosquitoes present.

Judicious selection of sites and extensive clearings of jungle will suffic for the more delicate jungle mosquitoes. Surface drainage will reduce th numbers of many others. Care in disposal of refuse and the artificia storage of water will prevent the multiplication of the more domestic species

For some species much can be done by treatment of comparatively small areas by individual effort, but for others larger areas must be treate and without combination of many persons in such cases little can be done.

Of the known disease carriers the Anophelines have been considere with some detail, and so has the commonest filaria bearing mosquito *Culex fatigans*.

Yellow fever does not now occur in Asia, but the mosquito which i capable of carrying it, *Stegomyia fasciata*, does occur in certain places. I has been pointed out that the opening of the Panama Canal may result in the conveyance of this disease from America to Asia. In such a case the Malay Peninsula would be one of the first places to receive the disease, and *the* condition for its propagation, the presence of *Stegomyia fasciata*, exists in Singapore, Penang, Kwala Klang, and a few other places in the Peninsula The main reliance is to be placed on the work done in the extirpation o this mosquito in the Panama Canal by the Americans, but as this may fail, early measures should be taken to deal locally with this mosquito, which is less widely distributed and less numerous than in most tropical countries. and so may be more easily dealt with.

General Principles as to Examination, Collection and Description of Mosquitoes.

By G. F. Liecester, M.B., C.M., Edin.

The following descriptions of mosquitoes are in the great majority of stances those of freshly killed specimens still showing their natural lours.

Most of the published descriptions, such as those in Theobald's onograph, are necessarily from dried specimens only, and there are nsiderable differences between the appearances observed in the fresh and d specimens.

From the entomological point of view a uniform system of examination dried specimens has advantages, but where the comparison can be made fresh specimens, specific characters can usually be more readily observed id certain errors avoided.

The main changes in a dried mosquito are distortion, denudation and ange in colour.

The distortion is often great, but varies in different species of osquitoes. Some, such as Anophelina, Melanoconion, etc., lose their ape and general aspect so much that their characteristic general appearnce is lost.

In others distortion of certain parts, as of the prothoracic lobes or the ead, takes place to such an extent that these parts when dried appear to ave characteristics which they do not possess in their natural condition.

Denudation is a change that very commonly occurs in old specimens o some extent. As the system of classification by cuticular appendages, articularly by the scales, introduced by Theobald, has proved of such alue for the differentation of genera and surpasses all other suggested nethods it is of the greatest importance that the specimens should be as ittle denuded as possible,

Change in colour is of great importance for specific differences. The olouration of scaled insects such as these culicidæ depends in part on the olour of the part of the insect examined and in part on the colour of the cales clothing that part.

Both these elements are affected by drying, but the changes in the olouration of the scales are most affected and are of most importance.

The colouration of many of these scales is a diffraction phenomenon nd varies with the incidence of the light as with most interruption colours. In the dried specimens these colours are always less vivid and are frequently ost. By the shrinking and distortion of the subjacent parts the inclination of the scales to each other is altered, and consequently a different series of changes of colour produced to that found in the same region in an undistorted mosquito. This is particularly marked in the Megarhines, but is not confined to that class.

The iridescence of the wings which forms so marked a feature of coloured plates of dried mosquitoes is only seen in a few species in the fresh condition.

In many mosquitoes it is impossible to be certain how much of the colouration is due to interruption colours and how much to the real colour of the scales. In all loss of brilliancy occurs. Brilliant glossy blacks become dull black or brown in old specimens whilst glistening white scales

with pearly iridescence either become dull white or yellowish or sufficiently transparent to allow the colour of the background to shew through and lend its tint to the scales.

Where possible the descriptions are those of mosquitoes bred from larvæ so as to have them in as perfect condition as possible.

It is a mistake to mount such mosquitoes as soon as they are hatched as the cuticle is so soft that great distortion occurs. If these mosquitoes are kept alive in the dark in a glass tube they make no efforts to escape and no denudation occurs. The tube should be corked. If cotton wool be used the mosquito often becomes entangled in it and partially denuded.

I have endeavoured to follow a uniform plan in my descriptions and to use descriptive terms always in the same sense both as regards shape, colour, and other appearances, and have conformed with some exceptions to the terminology adopted by Theobald.

In my descriptions I commence with an epitome of the more salient points of each mosquito. A detailed description of the head and its appendages follows. The thorax and its appendages is then described in order, beginning with the prothoracic lobes the obvious representative of the prothorax. The portion of the mesothorax which lies above the prothorax lobes I refer to as the "shoulder." It is an important region and is often clad with scales of a different shape and sometimes of a different colour to those on the rest of the mesonotum as in the Anophelina where there is a tuft of erect clavate or lanceolate scales in this region. There is no transverse suture in any of the culicidæ, but a marked difference of scaling is often seen on the portion anterior to where such a suture exists in other diptera, and in that on the part posterior to it. This different scaling seems to indicate this suture and for descriptive purposes it is convenient to speak of anterior and posterior in relation to the mesonotum and by such words to define the two portions separated by this imaginary suture so indicated which crosses the mesonotum a short distance in front of the wings. This division of scaling is well seen in *Culex gelidus* and *Stegomyia nivea*.

The rest of the mesothorax with its appendages, wings and legs is next described. For convenience the legs are all described together instead of with the special part of the thorax to which they belong. Descriptions of the metanotum, abdomen and genitalia follow in the order named.

In the descriptions the colour of the chitinous cuticle is given when it is not completely hidden by the scales.

This colouration varies to some extent with age, and still more in the more transparent mosquitoes with the colour of the contents, food, etc., of the thorax and abdomen.

In describing the scales, especially on the head, I have preferred to describe the shape of the scales rather than adopt the vaguer terms of "flat scales" and "narrow curved scales" used by Theobald, as in some of the genera the shape of the scales especially of the "flat scales" or their representatives appears to be characteristic and deviates from the definition of the terms.

The description of colours is a matter of great difficulty and involves a personal element. The colours vary with the amount of light, the angle at which the light strikes and the degree of magnification. A truer idea of the colouring of a mosquito is often obtained by examination with a hand lens than with a higher degree of magnification. I have tried to use the terms

nsistently, but do not think too much importance should be attached to inor discrepancies in the description of colouring.

Compound terms, such as blackish-brown, blue-white, etc., are used ecause they describe better the colours observed than any single word. heir use appears to me to be unavoidable.

Only species found in Malaya are here described, and except in the sub-mily Anophelina only such of these as either have not been previously escribed or described only from evidently insufficient material and so arrant a fuller description than has been possible from imperfect data.

A Greek terminology has been adopted throughout for generic names nd Latin for specific names. In nearly all the new genera the termination lyia (Greek μυῖα a fly) has been used for the sake of uniformity.

The order in which the sub-families are considered, following Theobald, as follows :—

Sub-family I.—Anophelinæ with genera :—Anopheles, Lophoscelomyia, Myzomyia, Myzorhyncus, Nyssorhyncus and Cellia.

Sub-family II.—Megarhininæ with genera :—Megarhinus, Teromyia and Toxorhynchites.

Sub-family III.—Culicinæ with genera :— Janthinosoma, Psorophora, Eretmapodites, Mucidus, Ekrinomyia, Desvoidya, Stegomyia, Leicesteria, Chætomyia, Dasymyia, Phagomyia, Catageiomyia, Polyleptiomyia, Scutomyia, Hulecœteomyia, Macleaya, Howardina, Acartomyia, Conopomyia, Skusea, Danielsia, Lophoceratomyia, Lepidotomyia, Geitonomyia, Theobaldia, Lutzia, Melanoconion, Culex, Gilesia, Grabhamia, Lasioconops, Tæniorhyncus, Mansonia, Orthopodomyia and Finlaya.

Sub-family IV.—Joblotinæ with one genus Joblotia.

Sub-family V.—Aedeomyinæ with genera :—Deinocerites, Aedeomyia, Aedes, Aioretomyia, Acalleomyia, Verallina, Mimomyia, Uranotænia, Ficalbia, Hodgesia, Zeugnomyia, Colonemyia, Topomyia, Hæmagogus and Skeiromyia.

Sub-family VI.—Wyeomyinæ with genera :—Wyeomyia, Phoniomyia, Dendromyia, Runchomyia, Sabethes, Sabethoides, Gœldia, Limatus and Malaya.

Sub-family VII.—Heptaphlebomyinæ with one genus Heptaphlebomyia.

The Culicidæ of Malaya.

By G. F. Leicester, M.B., C.M., Edin.

Sub-Family **ANOPHELINAE.**—*Theobald.*

Characters.—Palpi as long as or nearly as long as the proboscis in the female and in the male usually a little longer than the proboscis, the two last joints enlarged. Head clothed with narrow-curved and large flat topped upright scales and in all Malayan species there is a tuft of long hair-like scales projecting forwards from the vertex. Thorax and scutellum thinly clad either with hairs or hair-like scales or definite broad fusiform scales and on either shoulder above the prothoracic lobes is a dense tuft of upright scales. Wings generally spotted and clad with fusiform scales.

Remarks.—This sub-family has now been split up into eight genera each with well-marked characteristics. Except in the genus Anopheles the members of which have scarcely any scales on the head the head scaling is very similar in all but the thoracic and abdominal scaling varies greatly in species of the different genera.

Synoptic Table of Genera.

I.—Thorax, prothoracic lobes and abdomen with hairs only. Wing scales of uniform colour; where spots are present they are due to massing of the scales and not to differences in colour.....*Genus* 1.—Anopheles.

II.—Thorax, with hairs, except for a tuft of scales on the anterior margin projecting over the neck, and a dense tuft of palisade scales on each prothoracic lobe and above it on either shoulder.

(*a.*) Abdomen, with hairs and a few scales on the external genitalia. Hind legs with a crest of long erect scales at the knee.....*Genus* 2.—Lophoscelomyia.

(*b.*) Wings, with more than two costal spots. Last two abdominal segments with scales, but without ventral tuft.....*Genus* 3.—Myzomyia.

(*c.*) Wings, not more than two costal spots. Abdomen, with usually one or more central ventral tufts .....*Genus* 4.—Myzorhyncus.

II.—Thorax, with anterior tuft of lanceolate scales and shoulder tufts of erect scales and some scales on the dorsum which are usually narrow, but are definite scales. Abdomen, with hairs only ; there may be scales on the genital lobes.....*Genus* 5.—Pyretophorus.

V.—Thorax, with broad fusiform or lunate flat scales. Prothoracic lobes, with palisade scales on the upper angle and dense tufts above, on the shoulder.

(*a.*) Abdomen, with scales on the last segments and without ventral tufts.....*Genus* 6.—Nyssorhyncus.

(*b.*) Abdomen, heavily scaled and with ventral tufts of long scales.....*Genus* 7.—Cellia.

Genus 1.—**Anopheles.**

Thorax and abdomen clad with hair-like curved scales, practically hairs ; palpi, in the female thin, not densely scaled, generally unbanded. Wing veins covered with long lanceolate scales of uniform colour which may or may not form spots, but which, if present, are never so numerous as in other genera.

Remarks.—This genus is represented by only one species here.

Anopheles Treacherii. n. sp.

A small dull-coloured mosquito with hyaline wings without ornament. Thorax, pale brown with two darker brown lines anteriorly on either side of the middle line. Palpi and proboscis very lightly scaled. Legs, minutely banded white.

Female Head.—The whole of the head and facies of a translucent silvery-grey; eyes, brilliant bronze-green. In the dead specimen, head turns to a dark brown, eyes to black. At the posterior margin of the eyes the head has a slight fawn-brown tint and behind this there is a shadowing of black; on the vertex between the eyes there is a small tuft of white spatulate scales ; the orbital margins are bare ; there are a few scattered dark brown long upright forked scales on the occiput which extend back to the occipital foramen and laterally to the genæ, at the hinder edge of the bare space round the eye the orbital bristles are inserted, they are black, as are the two verticals. There are no other scales on the head. Basal joint of antenna brown and nude, remaining joints black, pale at the insertion of the verticils, verticillate hairs, black. Clypeus with a dark line down the centre ; nude. Palpi a little shorter than proboscis, joints indistinguishable, scaled with flat spatulate scales which shew a certain play of colours from purple to light bronze; there are some long black hairs at the base and others at the extreme apex. Proboscis, lightly scaled with brown scales, denser on the under surface and towards the apex than above and at the base, and with brown labellæ.

Thorax.—Prothoracic lobes small, dusky brown, destitute of scales but with a few black hairs inserted on each lobe. Mesonotum, brown, clad with a few scattered black bristles some of which are white at their bases but without scales of any sort. There are two dark brown lines in front one on either side of the middle line, and in the centre there is a very imperfectly marked third line. Pleuræ, colourless and without scales. Wings, with the whole wing surface clad with minute spines giving it a slightly brownish tinge; veins clad with narrow spindle-shaped median scales and narrow lanceolate lateral, in colour dark brown; first submarginal cell much longer and slightly narrower than second posterior, its stem scarcely half the length of the cell, its base much nearer base of wing than second posterior; median transverse vein nearer apex of wing than the supernumerary, posterior cross vein scarcely its own length from median cross vein; wing destitute of alula. There is a well marked spurious vein running parallel with the fifth for nearly its whole length between it and the sixth. Coxæ, colourless; femora, pale beneath. The scales of the legs are purple or dark brown according to the angle at which the light strikes them. Under a hand lens they appear paler at the apex of metatarsus and tarsal joints and give an appearance of banding, but under a 2/3 this does not shew, but the base of each joint is naked and light coloured, and I think the banded appearance is really due to this; it is best marked in the front legs. Ungues equal and simple on all legs.

Abdomen.—Reddish-brown dorsally, pale beneath, clad only with hairs dark brown in colour, without scales.

Male Head.—Under a hand lens from the front, grey, but if looked at from behind the vertex is black; there is a central white line running back from it and on either side a round eminence coloured light brown, outside this the eyes shewing through colour the head black. Under a 2/3 the colour is grey with a triangular black patch in front. The centre shews a deep median suture and on either side there is a muddy-brown tint. All this differentiation of colour is only seen in the fresh specimen and disappears when the head collapses on drying. On the vertex is a tuft of small white scales parted in the centre and composed of not more than 10 or 12 scales at the most, and the vertical bristles are white at the base, dark brown at the apex; over the rest of the head there are some scattered black bristles inserted, and behind on the nape two or three rows of brown upright forked scales. Basal joint of antenna muddy-brown, nude, remaining joints white except the last two or three which are dusky, verticillate hairs, dark brown. Clypeus nude, pale muddy-brown in colour. Palpi, slender and very lightly scaled with brown scales, last two joints, clavate; proboscis slender, similarly scaled.

Thorax.—Prothoracic lobes. Dusky, clad with a few black bristles. Mesonotum. A broad golden-brown line in the centre with three darker lines superimposed one on its centre and one at either margin, on each of these lines a row of bristles is inserted, some of which are white, some dark brown with white tips. The sides of the mesonotum have a greenish tinge, there are no scales. Scutellum, muddy-brown, with a black spot in the middle and brownish-black bristles, but no scales. Pleuræ, dirty white and naked. Wings as in the female. Legs as in the female, except that the fore and mid ungues are unequal, the large-unguis being uniserrate.

Abdomen as in the female.

Occurrence.—Described from a series bred from larvæ taken in hillside streams in jungle.

Remarks.—A very slender and fragile mosquito, entirely sylvan and apparently breeding only in jungle streams. The eggs are probably deposited in the swampy pools in the jungle forming the head-water of any hillside stream, and from here they may be carried down in heavy rain showers into the streams fed by such swampy areas, and thus the larvæ get into the rock pools in the course of such streams and even to the foot of the hills. This species is widely distributed in the Peninsula, but is not found in stagnant water or in water in the open. This anopheline is of very weak flight and probably quite unable to live in the open subject to the buffetings of stormy winds; it stands like a culex and to the naked eye looks much more like a culex, than an anopheles. It is a blood-sucker, it will not breed in captivity, and the larvæ, unless mature, usually die.

Genus 2.—**Lophoscelomyia.**—*Theobald.*

Head, with upright forked scales and some narrow curved ones on the vertex in front; thorax and scutellum clad with hairs and a tuft of long narrow scales on the anterior margin of mesonotum; abdomen with hairs only on all the segments but the two last, which are clad with lanceolate scales. Hind legs with a dense tuft of long erect clavate scales on both sides of the femorotibial joint. Wings, with blunt lanceolate scales.

Remarks.—This genus is represented by one species which breeds only in bamboos.

Lophoscelomyia Asiatica.—*Theobald.*

A small anopheline with the apices of the hind femora scaled with a tuft of long black scales succeeded by a tuft of long white, easily seen as a sort of ruff with the naked eye.

Head.—Black, frosted, when dry dark brown; the scales are arranged in tufts and bare places are left between, and as it is rather lighter along the orbital margins it appears under a hand lens to have a narrow white margin to the eyes; on the vertex is a tuft of long silky hair-like scales with a double curve on them which projects well forward, behind these are a few white narrow curved scales placed on either side of a bare black line and extending but a small way back and laterally for a short distance down the orbital margins, and behind these are some flat-topped white upright scales which merge behind into a dense mass of black (when dry, brown) upright scales extending laterally over the occiput to just short of the eyes from which they are separated by a bare space. I can perceive no flat scales anywhere. There are a few black narrow-curved scales following the white along the orbital margin. The eyes are a metallic bronze-green. Basal joint of antenna dusky, its depression brown, with some rather broad spindle-shaped white scales on its inner face, second joint light brown, some black spindle-shaped scales on its inner face, succeeding joints similar, but without scales; all joints, except basal, covered with short white hair; verticillate, pale brown with pallid tips. Palpi, equal in length to proboscis,

pallid, covered with long black scales and a few pale ones at junction of third and fourth joints, and some pallid hairs at the tip, best seen with a hand lens. Proboscis covered with black short scales, labellæ fawn coloured. Prothoracic lobes, blackish-brown with a tuft of dark brown erect scales.

Thorax.—Mesonotum: the greater part of the upper surface of a pale fawn colour (in some lights it has a greenish tinge) with a dark brown line in the centre in front; on either side there are two dark brown patches separated by a narrow pale line, which, if looked at sideways, look lighter, except for a small round dark spot at the upper part of pale line separating the two patches; in front is a rosette of fairly broad curved scales, white in colour, and the rest of the mesonotum is covered with scattered pale golden hair-like curved scales (white in some lights) and pale golden bristles. Scutellum with central part dark brown (black under a hand lens) and lateral portions same colour as mesonotum; a few pallid curved hair-like scales are scattered irregularly over it and the bristles are brown in colour. Metanotum same colour as thorax with a dark brown central stripe. Wings with costa black scaled, except for two yellow scaled areas involving first longitudinal, and the second spot involves the upper branch of second longitudinal. The first spot is placed rather more than half way from base of costa, second just before apex of wing. There are two patches of black scales, one at base of second long vein and the other at base of third and at base of fourth; there is a light scaled area on the lower branch of second longitudinal; the first sub-marginal cell, longer and narrower than second posterior, its base nearer base of wing; cross veins cannot be made out. All the rest of the veins clothed with black scales. Fringe black, except opposite yellow apical spot where it is golden-yellow. Pleuræ, dark brown, marked with pallid lines. Coxæ, pallid; fore legs clothed with black spindle-shaped scales with a purplish hue in some lights; knee spot pale and a few pale scales at junction of tibia and metatarsus. Mid legs same as front, except for a conspicuous patch of white scales on the dorsum of the femora just before the apex.

On the hind legs, a little before the apex of each femora, is a dense tuft of lanceolate scales, which stand out on either side conspicuously, and where this ends the femora becomes snowy-white and is clad with similar long scales snowy-white in colour and erect. There is no banding of the tarsi. Fore and mid ungues equal and simple.

Abdomen.—Dorsum, greenish-yellow, except segment four, which is dark brown; there are numerous pale golden hairs. On the last segment there are numerous golden-brown and dark brown lanceolate scales. The apices of the segments are slightly darker than the bases. The segment ventrally is transparent, white basally and dusky black apically.

Male Head.—Muddy-brown when fresh, dark brown when dry; between the eyes is a triangular space bordered on either margin by white narrow curved scales, and more to the front by long silky white hair-like scales, which cross and project forwards over the facies. Behind this space are a number of white spatulate scales standing upright like palisades. The ends are not forked. Passing backwards towards the nape and also laterally is a dense tuft of upright scales which become darker and darker the further back they are placed. Basal joint of antenna dark brown, succeeding joints dirty white at the base, yellowish at the apex, plumes pale tawny-brown. Palpi, with long black scales at the base on their outer sides, dark brown scales over the

whole of the apparent first joint, except for a ring of pale scales about its middle, a ring of yellowish scales at junction of the penultimate and antepenultimate joints. Upper surface of apical half of penultimate joint scaled with yellowish scales, and all the terminal joint except for a patch of black scales near its base. Proboscis uniform.

Thorax.—Pale fawn-brown, with a median-dark line and lateral dark brown patches, and on the anterior margin a rosette of long narrow-curved white scales. Hair-like golden bristles arranged in lines are distributed over it. There is a dark spot in front of scutellum. Wings, the costal spots are much paler yellow than in the female. The first spot is very long and commences fully 2/3 from the base of the costa, second spot small and near the apex, both involve costa to first longitudinal, the second involving also upper branch of second long vein; at base of second long vein is a distinct patch of black scales and a few are scattered along the course of this vein; there is another patch at base of third vein, and another near the base of fourth and a very few along the course of the vein. Besides these and the scaling on the costa and subcosta and first long vein, there are no other dark scales on the wing. In the feathering of the hind legs and the markings of the legs generally it resembles the female.

Abdomen as in the female.

Occurrence.—Described from a series bred from larvæ taken from water in pierced living bamboos or split fallen bamboos.

Remarks.—As far as I know exclusively a bamboo-breeder. The larva is very distinct, being of a light yellowish-brown colour with a large conspicuous black patch on the mesonotum, in shape something like a Maltese cross. I have never taken the adult. Those bred in captivity will not bite.

Genus 3.—**Myzomyia.**

Thorax with a tuft of narrow scales on the anterior margin, hairs elsewhere. Abdomen with hairs on all the segments except the last, which in most species is clad with narrow scales. Wings with more than two pale costal spots and usually long thin lanceolate scales on the veins.

Remarks.—This is one of the largest genera of the family and is well represented in Malaya. Five species are known. *M. Rossii* is probably the most widely distributed and commonest of the urban anophelines in the Peninsula.

Myzomyia Albirostris.—*Theobald.*

A rather small anopheline, apparently entirely a stream and pond breeder, with four definite yellow spots on the purple-black costa. The apical half of the proboscis is golden scaled, the basal being black, and the last joints of antennæ are scaled yellowish-white.

Female Head.—Dark brown, space between the eyes broader than usual. Immediately in front on the vertex are some double curved long silky white scales, behind these on either side of a bare line are placed a few white narrow spindle-shaped curved scales, which latter extend back into a patch of upright scales, white in the centre and creamy-yellow at the sides, which do not spread far laterally; behind these bordering the occipital foramen and

extending laterally are two or three rows of black upright scales, which are longer than the white and more definitely forked. There are no flat lateral scales. The space immediately behind the eyes is bare. Five black bristles are inserted at the orbital margin on each side. Basal and second joint of antennæ light fawny-brown, remaining joints dusky, scales (if any) on basal joint very scanty and minute; second joint with a few white spatulate scales, remaining joints hairy, verticillate hairs short. Each joint being rather stout, the whole antennæ has a moniliform appearance. Clypeus black, nude. Palpi, four-jointed, scaled at the base with long black scales; midway in the second joint is a nodal thickening, and here there is a band of creamy scales; the apex of the second and the whole of the last two joints are covered with creamy scales. In some specimens a few black scales are placed on the upper surface of the apex of the penultimate joint. Basal half of proboscis black scaled, the apical half golden scaled.

Thorax.—Prothoracic lobes very prominent, conical. The apex which looks outwards, forwards, and downwards, so separated from the body of the lobe by a distinct line of the chitin, which may or may not be a sulcus, that the appearance is almost that of a teat. There are no scales, but a few black bristles. Mesonotum, light fawn-brown in colour, with a narrow dark brown line running down the centre which broadens out posteriorly. On either side of the posterior half is a light brown line, and anteriorly there is patch of bluish-white long narrow curved scales pointing outwards on either side of the middle line, the rest of the mesonotum is clad somewhat sparely with long pale golden hairs. On either margin posteriorly is a line of long bristles, golden at the base, dark brown at the apex. Scutellum in colour similar to mesonotum with a dark spot in the centre, and a few pale hair-like scales inserted on its surface. There are 14 scutellar bristles, pale golden basally and dark at the apex. Pleuræ, dark brown, abruptly marked off from the mesonotum: Wings: costa black-scaled with four yellow spots, the first spot placed about 1/3 of the length of the costa from its base, involves the subcostal and the first longitudinal, the spot on the last vein being nearly three times as long as on the costa, the second spot is rather nearer the first than the first is to the base, and passes on to the first longitudinal, and is of equal length on the two veins and costa, the third spot is nearer the second than the second to the third and separating it from the next spot, which is apical, is a patch of black scales, but little longer than the yellow spot, the apical spot is variable, being sometimes well marked, at other times broken by a few black scales. The fringe and border scales are black, except where the veins from the third onwards terminate, at these spots, the scales are white; second long vein is pale at the base, black scaled at the apical half of the stem and on its branches except for a patch on each a little way from their bases; third vein entirely pale scaled, except at its extreme tip, stem of fourth vein has the basal third pale scaled apical 2/3 black scaled; except for a spot of pale scales at the junction of the cross vein, upper branch alternately pale and black scaled, lower branch entirely pale scaled; stem of fifth vein pale scaled, save for a spot of black scales near the base, upper branch pale scaled with three spots of black, two near the base and one at the apex, lower branch, with one black spot at apex; sixth vein shews three black spots. The pale scales on the wing are a pale golden colour and in shape are narrow lanceolate. Legs: front and mid coxæ, pale above and dark brown beneath, hind coxæ entirely colourless; legs clothed with

urple-black scales, with a few pale scales at the apex of the tibiæ; the fore metatarsi and first two tarsal joints are apically banded pale yellow. This anding varies, in some being much more marked than in others, and sometimes, on the inner surface, involving both sides of the joint. The hind metatarsus and tarsal joints are very minutely banded. Ungues equal nd simple on all the legs.

Abdomen.—General colour dark olive-green. When dry it becomes a ark brown. The whole abdomen is clothed with ochre-yellow hairs, and is bsolutely destitute of scales.

Male Head.—Scaled as in the female. All the joints of antenna, except he last two which are black, light brown; plumes, silky fawn-brown in a trong light, darker brown in a poor light. Palpi, longer than the proboscis y the last joint. First apparent joints scaled purple-black. In the centre he scales are absent, and the bare place has the appearance of a ale ring. The apex of this joint is broadly scaled with pale golden scales. econd joint has at the base a few black scales above, but the under surface is ntirely black scaled, the rest of the upper surface and the lateral surfaces re creamy scaled, the terminal joint is similarly scaled except that the lack scales beneath do not reach to the extreme tip which is creamy scaled. roboscis clad with purple-black scales, labellæ golden. Legs, fore and nid ungues unequal, larger uniserrate. In all other respects the male esembles the female except for the more lightly scaled wing and the genitalia. The male genitals are scaled with small dull-coloured narrow flat scales, ery difficult to see. The claspers are as long as two complete segments.

Observations.—The larva of this mosquito is found in small running streams with grassy edges, and in larger ponds supplied by springs. The adult I have caught in my bungalow, Kuala Lumpur. It is a blood-sucker. It s easily identified when fresh by the parti-coloured proboscis, when dry, however, this is not so easily seen as the colours fade.

Myzomyia Rossi.—*Giles*.

Head, dark slate, with a tuft of long silky white hair-like scales on the vertex and behind these white upright scales succeeded by brown scales. Thorax, light fawn-brown, thinly covered with hairs. Palpi, with two creamy bands and creamy apex. Wings, with costa alternately brown and creamy-yellow. Legs banded.

Female Head.—Dark slate, clad with a tuft of long silky white hair-like scales on the vertex between the eyes, followed behind by the tufts of shorter linear white scales, and behind these are numerous rows of white upright scales, and still further back, rows of dark brown upright scales which extend laterally. Basal joint of antenna, pale apricot, with a few pale scales on the upper surface, second joint almost black, clad with small white scales, remaining joints dark brown with silvery downy hairs and silvery verticillate hairs. Clypeus, apricot. Palpi, clad with dark brown scales with a ring of creamy (sometimes pale yellow) scales at the apex of the second and third joints, the fourth is clad entirely with dark scales on its basal third, and creamy-yellow scales beyond, while the ultimate joint is entirely clad with creamy-yellow scales. Proboscis, clad with dark brown scales with reddish-brown apex.

Thorax.—Prothoracic lobes, pale fawn-brown with a tuft of light brow scales on the apex of each. Mesonotum varies in colour, but as a rule (u less the mosquito has had a meal of blood when it becomes almost black) a pale fawn-brown, clad with pale golden almost white hairs, and a tuft creamy scales on the anterior margin over the neck and a small tuft scales on each shoulder. Scutellum, pale brown at the sides, dark brown i the centre, clad with pale hairs only. Pleuræ, pale yellowish-brown wit dark brown spots clad with a few pale hairs. Wings clad with dark brow and creamy-yellow scales. On the costa, at the base, are two yellow-scale patches separated by a short brown-scaled area, then a long brown spo followed by a short yellow spot, then a long brown-scaled area, then yellow brown and yellow spots of equal length. The yellow and brown spots o the subcosta correspond exactly to those on the costa. The first long vei is clad with yellow scales for the first 3/4 of its length, except for a sma brown spot beneath the first long costal spot, and another small brown spo in the middle of the second long costal spot, which forms with it th T-shaped spot generally described as a characteristic of this mosquito' wing. Beneath the third long dark costal spot the first vein is brown-scale and also at its apex. The rest of the veins are clad with creamy scales an small spots of black scales as follows: two dark spots on each branch of th second vein, one at the base, and one at the apex of the third vein, a long blac patch on the fourth vein just before it forks, two on its upper branch and on on the lower, and one at the base of the fifth vein, three on its upper branc and one at the apex of the lower branch, and two on the sixth vein. Ther is a pale spot on the fringe at the junction of every vein with the margin first fork cell narrower and a little longer than second, the bases either leve or that of the first fork cell nearer the base of the wing; cross veins variable as a rule the median is a little nearer the base of the wing than the super numerary, and the posterior cross vein is about twice its own length distan from the median, but it may be only 1½ times its length distant from th median. Coxæ, creamy-white with creamy-white scales. Legs, clad wit dark brown scales with purple reflections. On the fore legs there is a creamy yellow band at the apex of the metatarsus, at the apex and base of the nex two tarsal joints, and at the base of the third tarsal joint. The banding o the mid leg is similar, but not so broad. On the hind legs there is a narro band at the apex of the metatarsus and of the first three tarsal joints Ungues on all the legs simple and equal.

Abdomen.—Pale yellowish-brown, with a dark line running down th centre of the dorsum as far as the fourth segment, and an ill-defined dark lin on either margin. All segments, except the last, clad with numerous pal golden hairs. On the last segment are a few dark brown clavate scales i addition to the hairs.

Male.—Head as in the female. Plumes, flaxen. Palpi, clad with dar brown and creamy-yellow scales. The basal half of the first apparent join dark brown, a narrow ring of creamy scales just beyond the middle, then a broad band of dark brown scales followed by creamy scales. On th ventral side of the extreme apex of this joint are a few dark brown scale at the base of each. The scaling of the wing is less dense and the "T" spot is not so marked, the first long vein having two patches of brown scale beneath the second long costal spot instead of one central spot, the fork cell

e shorter and the base of the second is decidedly nearer the base of the ing than that of the first; genital lobes clad with dark brown and flaxen ales. Fore ungues markedly unequal, the larger unguis with one tooth. ngues of mid and hind legs equal and simple.

Occurrence.—Larvæ taken in roadside puddles or any small collection of agnant water near houses. Adults taken in bungalows at Kuala Lumpur, ingapore, Penang, Klang, etc.

Remarks.—Though variable as to colour it is easily recognised, the only her Malayan species at all resembling it is M. Albirostris, but the banding the proboscis and palpi and the scaling of the wing differ considerably in ie two species.

MYZOMYIA PUNCTULATA.—*Donitz.*

Proboscis, with the apical half clad with pale creamy-yellow scales. 'alpi, with a narrow silvery band and two broad silvery bands and a silvery pex. Costa, with five yellow spots and numerous yellow spots on the ring field. Thighs and tibiæ spotted.

Female Head.—Black, with white hair-like scales, and short linear scales on he vertex and a few white upright scales behind these, followed by dark brown ipright scales behind and at the sides. Basal joint of antennæ, dark brown, econd joint brown with silvery scales, remaining joints brown with silvery lowny hairs and silvery verticillate hairs. Palpi, clad with dark brown cales with a narrow ring of white scales at the apex of the second joint; the basal half of third joint is dark brown, the apical half creamy-white, and the ast two joints are entirely creamy save for a very narrow brown ring at he base of each. Apical half of proboscis, tawny-yellow.

Thorax.—Prothoracic lobes, dark brown with dark brown scale tufts. Mesonotum, dark brown, with an eye-like spot in front of either wing and a large dark spot at the base of the scutellum, with few bluish-white narrow curved scales inserted on the anterior margin, and a tuft of small spatulate bluish-white scales on each shoulder, the rest of the mesonotum being clad with pale hairs and dark brown bristles. Scutellum, dark blackish-brown in the centre, paler at the sides. Pleuræ, blackish-brown and nude. Wings clad with dark brown and yellow scales:—First third of costa broken by three yellow spots the last of which involves the first long vein; the middle third is brown scaled with one large yellow spot where the sub-costa joins it, the apical third is first brown, then yellow, brown, and yellow, the rest of the veins are brown scaled with numerous yellow spots; the fringe is yellow wherever a vein joins the margin; the lateral scales are lanceolate; first fork cell longer and narrower than the second, its base considerably nearer the base of the wing; posterior cross-vein about twice its own length from the median. Coxæ, dusky brown. Legs, clad with dark brown scales with numerous creamy-yellow spots on femora tibiæ and metatarsi. The apex of each metatarsus and tarsal joint has a creamy-yellow band, those on the fore legs involving both sides of the joint.

Abdomen.—Black, clad with pale hairs only.

Male.—Plumes, pale fawn-brown. Palpi, with last two joints enlarged, both clad with golden scales and a narrow basal ring of dark brown scales; antepenultimate joint with a ring of creamy scales about its centre, a

broader ring just beyond this and some creamy scales on the inner side the apex. Proboscis, clad entirely with dark brown scales. The yello scales on the wing are much more numerous than on the wing of the femal and are much paler, being almost white. At the point of junction of su costa and costa, the costa is brown-scaled, beyond this there is first a lar patch of pale yellow involving the first vein, followed by a short brown spo which is succeeded by another large pale yellow spot. Fore ungu unequal, the larger unguis uniserrate. Mid and hind ungues equal ar simple.

Occurrence.—Described from two males and two females, one take in my bungalow at Kuala Lumpur, one in bungalow at Klang, and the oth two bred from larvæ.

Remarks.—Although the scaling of the wing, especially on the cost and first long vein, differs in my types from the description and drawin in Theobald's Monograph, there can be no doubt they are M. Punctulat The specimens of males from which my description is drawn, differ a goo deal from the female, notably in the size of the yellow spots on the cost and in having an entirely dark-scaled proboscis. Still the male and femal were bred out from the same batch of larvæ, and in spite of the differences I have described them as male and female of one species.

Myzomyia Leucophyrus.—*Donitz.*

Palpi, with two creamy bands and two yellow bands. Thorax, reddish brown with black eye spots. Wings, with four large and two small basa yellow spots on the costa, and numerous small yellow spots on the wing field Thighs and tibiæ much spotted. A broad creamy band at the tibio metatarsal articulation on the hind leg.

Female Head.—Deep blackish-brown, long silky hair-like scales in front between the eyes, and a few short linear white scales behind them with bluish-white upright scales in front and deep brown to black upright scales behind and on the sides. Basal joint of antenna dark brown, second joint brown with silvery scales on the inner side, remaining joints brown with silvery downy hairs and verticillate hairs brown with pale tips. Palpi shorter than the proboscis, clad with dark brown scales. There is a ring of silvery scales at the apex of the second joint, and a narrower ring at the apex of the third joint, the banding on the fourth joint occupies nearly half the joint and is golden, while the fifth is entirely golden, except for a narrow basal ring of dark brown. Proboscis, black, with golden-brown labellæ.

Thorax.—Prothoracic lobes, dark brown, with blackish-brown scales on the apex of each, and a row of black bristles. Mesonotum, reddish-brown, with a large dark brown eye-like spot on either side in front of the wings, a tuft of creamy-white narrow scales inserted on the anterior margin above the neck, and a tuft of dark brown clavate scales on either shoulder above the prothoracic lobes, the rest of the mesonotum is thinly covered with pale golden hairs. Scutellum, dark brown in the centre, paler brown at the sides, clad with pale golden hairs. Pleuræ, brown, with two rows of large dark brown spots clad with a few pale golden hairs. Wings, with dark brown and pale yellow scales. Costa, brown-scaled, with five golden spots, three subequal ones in the basal third involving only the costa, one at the junction

the subcosta and costa which involves the first long vein, and one near e apex the broadest of all which also involves the first vein. All the rest the veins brown-scaled with small yellow spots as follows:—two on e stem of second vein, three on its upper branch and two on its lower, six the third vein, one on the stem of fourth where the cross vein meets and one at the base of the fork cell, with three on its upper branch, and one its lower, four well-marked ones on the stem of fifth vein, three on each of its anches and three on the sixth vein; apical fringe golden and a spot of golden nge scales where the branches of the second fork cell and the upper branch the fifth vein join it; posterior cross vein about four times its own length m median. Coxæ, brown; femora and tibiæ, clad with brown scales and merous golden scales arranged as spots; fore metatarsus and tarsal joints gely clad with golden scales, the brown forming small bands in the centre each; mid metatarsus, brown with golden spots, tarsal joints, brown with rrow apical bands; hind tibiæ, each with apex enlarged and the apical th clad with creamy scales, which, with a similar band on the base of the etatarsus, forms a conspicuous creamy band at this articulation; tarsal ints, brown with well-marked apical bands.

Abdomen.—Black, with numerous pale golden hairs, on the last segment a dense tuft of golden-brown hairs and scales mixed.

Male.—Plumes of antennæ, tawny. Palpi, with a creamy ring at the ntre of first apparent joint and a narrow golden-brown ring at the apex, st two joints enlarged, clad with golden-brown scales and a narrow asal ring of dark brown scales. Fore ungues, unequal, the large unguis, niserrate, hind and mid, equal and simple.

Occurrence.—Described from a large series bred from larvæ taken from ater in open bamboos and pools in jungle.

Remarks.—So far as I know this mosquito is entirely sylvan. It is ne of the largest and most handsome of the Malayan Anophelina, and can be t once distinguished by the tibio-metatarsal articulation on the hind leg. he male is here described for the first time.

Genus 4.—**Myzorhyncus.**—*Theobald.*

Head, with a few narrow-curved scales on the vertex and numerous pright scales elsewhere. Prothoracic lobes, with dense apical tufts of lavate upright scales. Mesonotum, with upright clavate scales on the houlders and pale hairs on the dorsum. Scutellum, with hairs. Abdomen, vith hairs, and generally a ventral tuft of long clavate scales on the eighth egment. Genital lobes in the male clad with scales, in the female generally lad with hairs only. Wings with not more than two costal spots. Wing cales, lanceolate or fusiform.

Remarks.—Six species of the genus are said to occur in the Malay Peninsula. Sinensis, Vanus, Annularis, Barbirostris, Albotæniatus and Umbrosus. I have included specimens with the characters of Sinensis and Vanus under the one name, Sinensis, and have added two new species, Peditæniata and Separatus. The species fall into two natural groups, hose with banded palpi, which includes Sinensis and Peditæniata, and hose with unbanded palpi, M. Barbirostris, Albotæniata and Umbrosus. I have no specimen which would correspond to the description given of Annularis.

MYZORHYNCUS SINENSIS.—*Walker.*

Head, slate-grey, covered with long silky white hair-like scales on th vertex, numerous bluish-white palisade scales on the occiput and behin dark brown palisade scales. Wings, with two golden costal spots an golden apical fringe. Thorax, dark slate-grey with golden hairs. Leg narrowly banded.

Female Head.—Dark slate-grey: on the vertex, projecting forward between the eyes, a tuft of long curved silky white scales, and some shorte falciform scales of similar colour; behind these are rows of bluish-whit palisade scales, and further back, rows of dark brown palisade scale extending laterally. Basal joint of antenna, dark brown, with a few silver spatulate scales, second joint, dark brown, as long as any two succeedin joints, and scaled with clavate silvery scales, as are the next two joints remaining joints, dark brown with silvery down; verticillate hairs, dar brown. Palpi, as long as the proboscis, heavily scaled with long clavat scales, especially long at the base, with a ring of white scales at the base o the third, fourth and fifth joints, and the apex of the fifth has some whit scales. The white scaling involves both sides of the joint. Proboscis entirely covered with dark scales, very long at the base.

Thorax.—Prothoracic lobes, dark slate-grey, almost black, with a dens tuft of dark brown palisade scales on the upper third. Mesonotum dar slate-grey behind, chestnut-brown in front, with dark slate lines, thinly cla with long golden hairs. Scutellum, dark slate, sometimes chestnut-brow with golden hairs. Pleura, dark blackish-brown with a few golden hairs Wings, clad with brown and creamy-yellow lanceolate scales, distributed as follows:—Costa, with dark brown scales broken by a golden-yellow patch of scales about its centre, which extends on to first long vein, and anothe spot close to the apex which extends on to the second long vein, first long vein with three patches of yellow scales, the first being the longest and clos to the base, the other two corresponding to the costal spots, second long vein with its stem clad with brown scales on its basal half and yellow scales on its apical half; the upper branch has brown scales as far as the apical costal spot, where the scales are yellow, followed by brown to the apex, the lowe branch being creamy-scaled except at base and apex; third vein creamy yellow except at base and apex, fourth vein mottled with both coloured scales to its division, where there is a patch of brown scales and another spot of dark scales at apex of each branch, fifth vein yellow in most of its length, with a basal patch of brown, and three ill-defined brown spots on its upper branch and one on its lower; sixth vein, yellow with two brown spots; fringe, yellow from upper branch of second vein to apex of third, black for the rest of its course. Coxæ, dark brown with scales. Legs, with dark brown scales with creamy bands at the apices of the metatarsal and first two tarsal joints of all legs. Ungues, equal and simple.

Abdomen.—Dense brown with golden hairs; eighth segment with ventral tuft of long dark brown scales.

Male.—The scaling of the head resembles that present in the female, but the palisade scales behind are lighter brown. Basal joint of antenna very large and dark brown in colour and without scales, remaining joints dirty-white in colour with dense plumose light-brown verticillate hairs, a few scales

the second joint, but none on any of the succeeding joints. Prothoracic bes with dense tufts of brown palisade scales. Proboscis, longer than the female. Palpi, with last two joints swollen, the under surface of enultimate joint beset with long golden hairs, upper surface mostly clad ith white scales, ultimate white scaled above. Wing, scaling similar that of the female.

Occurrence.—Larvæ taken in ponds and roadside ditches both in towns nd country.

Remarks.—I have included under this name specimens which vary in inor points. The presence or absence of a pale patch in the wing fringe pposite the lower branch of the fifth vein is not of specific importance, as pecimens can be obtained shewing every gradation from no spot to a spot f some size. The amount of leg banding varies very considerably. Ir. Theobald does not make separate species of those with narrow bands nd those with broad. From Peditæniatus this mosquito differs chiefly in he wing scaling. In Sinensis the yellow scaling predominates, and the rown scales are more or less collected into small spots, while it is exactly he reverse in Peditæniatus. The real reason for separating them bsolutely is the difference that there is in the larvæ from which they espectively hatch.

Myzorhyncus Peditæniatus. n. sp.

Head, dark slate, with blue-black and dark brown upright scales and a ong white tuft on vertex. Prothoracic lobes, black-brown with tuft of black-brown palisade scales on the apex of each. Thorax, dark slate, with larker lines and eye spots clad with pale golden hairs. Wings, with two costal spots and golden apical fringe. Hind legs broadly banded.

Female Head.—Dark slate; a tuft of long silvery hair-like scales on the vertex, a bare line running back from this to margin of occipital foramen, on either side of this from before backwards are first, some silvery narrow blunt-ended scales curved on the flat, which are succeeded by bluish-white upright scales arranged in transverse rows, and these are succeeded by rows of dark brown to black upright scales which spread laterally. Eyes, when fresh, brilliant bronze-green, with purple bands, like the eyes of a tabanid. Basal joint of antenna very small and dark brown in colour, remaining joints, black, with pale rings at the insertion of the verticils, and white scales on the first few joints, downy white hairs on the remainder; verticils, black; second joint about $1\frac{1}{2}$ times the length of any succeeding joint. Clypeus, black. Palpi, heavily scaled at the base with long black clavate scales; sometimes there are a few white ones on the upper surface. There may or may not be white scales at the junction of second and third joints, and again at junction of third and fourth, but there is always a well-marked silvery band at the base of the fifth joint, and also at its apex. The palpi, when fresh, are exactly the length of the proboscis, but when dry they may be longer or shorter according to the respective amount of shrinkage. Proboscis, black-scaled throughout, with brown unscaled labellæ.

Thorax.—Prothoracic lobe, blackish-brown, with a dense tuft of dark brown upright clavate scales on its apex. Mesonotum, dark slate, with brown shoulders and dark lines, one central in front, one on either side

of this and behind a dark line running forward from each corner of th scutellum and ending opposite the wing bases in an eye-like spot. On th anterior margin is a tuft of very narrow hair-like bluish-white scales, and o either shoulder, immediately above the prothoracic lobes, is a tuft of clava palisade scales, dark brown in colour; the remainder of the mesonotum sparsely clad with pale golden hairs. All the above is plainly seen in fres specimens, but when dry the distortion is often so great that whether th tuft of scales on the shoulder is inserted on the mesonotum or the prothe racic lobe is very difficult to decide. The scutellum is dark slate and cla with golden hairs. Pleuræ, dark blackish-brown apparently without scale Wings, heavily clad. In some specimens the scales are darker than other and those on the wing of the female are always much darker than on the mal wing. The colours in a good light are purple and yellow or orange. Unde a higher power where there is great loss of light the purple scales appea black and the yellow may become brown. There are two costal spots, th first about the junction of the middle and apical thirds just beyond the poin where the subcostal vein joins the costa and involving the first long vein, th second spot is close to the apex and spreads on to the upper branch of th second vein, following this on the margin, the fringe is dark scaled for short distance and then golden scaled as far as the junction of the third vei with costa; the subcostal vein is brown scaled in its entire length; the firs vein is clad with brown scales except opposite the second costal spot; th second vein is entirely brown scaled, save for a yellow spot on both its branches the third vein is yellow scaled except for a dark basal and apical spot; fourth vein, dark scaled, save for a yellow spot on each branch; fifth vein, yellow scaled, except where its branches join the costa and for a short distanc along its upper branch; sixth vein, yellow with two dark spots; fringe scales black, except for portion already mentioned; border scales, yellow; cross vein of about equal length and equidistant the one from the other. Coxæ, dark brown, almost black, clad with a few dark scales. Femora and tibiæ of all legs with dark brown scaling above and laterally and paler brown beneath. In the fore leg there is a creamy-yellow band at the apex of the metatarsus a broader one at the apex of the first tarsal joint and another not quite so broad as the apex of the second tarsal joint. Similar bands are seen on the mid legs. On the hind legs there is a narrow creamy-yellow band on the apex of the metatarsus, one a little broader on the apex of the first tarsal joint, and one much broader on the apex of the second tarsal joint; the third tarsal joint has a narrow basal band and a broad apical one, the fourth tarsal joint is dark brown scaled.

Abdomen.—Black, with pale spots at the sides on the first two or three segments. All segments thinly clad with pale brown or ochraceous hairs eighth segment with a ventral tuft of blackish-brown scales.

Male.—Head, clad with scales similar to those on the female head Antenna, plumose, with two last joints elongated, basal joint, black, remaining joints banded black and white, verticils steel-grey. Palpi, longer than the proboscis by the last joint; last two joints swollen, with a row of long hairs along the inner side of the upper face, upper surface of ultimate joint clad with silvery scales at the base and apex, and dark blue-black or purple-black scales between, penultimate joint with black scales with purple reflection, except for a narrow band of silvery scales at the base on the upper

surface only. When the specimen dries the palpi become so distorted that the amount of white scaling is made out with difficulty. The wing is much more lightly scaled than in the female and there is only one dark spot on the sixth vein. The lateral aspects of the abdomen are fringed with long ochraceous hairs. The genital lobes are densely clad with dark brown scales.

Occurrence.—The larvæ are to be found in any large collection of water in the open, such as lakes and large ponds supplied by springs. They are not to be found in very stagnant water.

Remarks.—Described from a large series bred from larvæ. The larvæ differ constantly from those of M. Sinensis. The wing scaling also differs from that of M. Sinensis as it is much darker and the contrast of the two colours is more pronounced and the lateral scales are broader. The posterior cross vein is much nearer the median in M. Sinensis than in this mosquito.

In the larva of M. Sinensis each frontal hair consists of a short thick stem supporting numerous stiff bristle-like hairs, in *M. Peditæniatus* it is formed by a long thin stem which splits into a few (five or six) fine hairs.

Myzorhyncus Barbirostris.

A large black mosquito with very heavily scaled palpi and proboscis. Thorax, dark slate with golden hairs. Palpi, without white bands. Wings, with two costal spots and a pale spot on the fringe opposite the lower branch of the fifth vein. Legs, minutely banded.

Female Head.—Black. A tuft of long hair-like ochraceous scales and a few shorter or narrow curved scales on the vertex, behind these, one, or perhaps two rows of bluish-white upright scales, succeeded by scales which are black in some lights, blue-black in others. Basal joint of antenna, black, with a few small black scales on its upper face, second joint black, as long as any two succeeding joints, and clad with a few brownish-black clavate scales, remaining joints black with white downy hairs and black verticils. Palpi, as long as the proboscis, clad entirely with black scales, which, when dry, have a brownish tinge; towards the base they are very long and stand out from their insertion, making the palpi appear very thick. Proboscis, black scaled.

Thorax.—Prothoracic lobes, black, with a tuft of black clavate palisade scales on the apex of each. Mesonotum, black with a silvery frosting, clad in front just over the neck with rather long narrow white scales, and on either shoulder above the prothoracic lobes with a tuft of clavate palisade scales, dark blackish-brown in colour, the rest of the mesonotum is thinly clad with hair-like scales which are creamy, with some pale golden ones intermixed; scutellum, black, with creamy hair-like scales and golden bristles. Pleuræ, black, with a few long hair-like creamy scales below the wing, and some clavate scales on the portion between front and middle coxæ. Wings, narrow, clad with black and creamy scales, these latter are sometimes pale yellow. Costa, clad with black scales, except where the subcosta joins it, where there is a creamy spot and at the apex where the first long vein joins the costa is another small creamy spot; subcostal vein entirely black

scaled, first long vein, entirely black scaled, except for a few creamy scales in two patches about the centre and creamy scales at its extreme tip; stem of second vein, entirely black scaled, upper branch black scaled, except for a small portion at its apex, lower branch black scaled at base and apex, and in the centre a patch of creamy scales; third vein, mottled with black and creamy scales; fourth vein, with black scales on its stem, its upper branch mottled, the black scales predominating, its lower branch with yellow scales, except at its base and apex; fifth vein, with a definite patch of black scales near its base, beyond this chiefly yellow scaled with scattered black scales intermixed; sixth vein, with mostly yellow scales, except for two patches of black; fringe, black except for a few yellow scales opposite each costal spot and similar patches opposite the junction of third vein, with margin and the lower branch on the fifth; border scales, black. All legs black scaled with small creamy apical bands to all the tibiæ to metatarsus and first tarsal joint of fore legs and metatarsus and first three tarsal joints of hind leg.

Abdomen.—Black, with dark brown hairs and tuft of dark brown scales on the venter of the eighth segment.

Male.—Head, as in the female. Antennæ, with blackish-brown plumes and joints banded black and white. Palpi, entirely black scaled, longer by the last joint than the proboscis. Leg banding is broader than that in the female and the wing is more lightly scaled.

Occurrence.—Adults taken in bungalows in Kuala Lumpur and in jungle in Klang. Larvæ taken in any large piece of water in the open in various parts of the Peninsula.

Remarks.—A very distinct and easily recognised mosquito. When seen at rest the points that immediately strike one are its blackness, the great size of palpi and proboscis, and the size of the whole mosquito. It is a fairly common mosquito both in houses and jungle, and is the least variable as to markings of any member of this genus. From Umbrosus it can be at once told by the presence of two costal spots and a pale patch opposite lower branch of fifth vein. The larva is very distinct and is invariably self-coloured, and may be either pure black or rich grass-green or olive-brown. The larvæ described by Mr. Theobald in Vol. III. "Monograph of Culicidae," is, in my opinion, the larva of his Sinensis and not Barbirostris. I have examined more than a hundred of these larvæ and have never found one with white bands. These are common enough on the larvæ of Sinensis. The larvæ of Sinensis and this mosquito, have both a branched lateral hair on the antenna, but the frontal hairs differ, that of Sinensis being composed of much thicker hairs than in Barbirostris. The head of Barbirostris larva is nearly always light brown, that of Sinensis is invariably black.

Myzorhyncus Albotæniatus.—*Theobald.*

Head, black with blue-black scales and a tuft of pale golden scales on the vertex. Wings, with two costal spots and with black apical fringe. Hind legs broadly banded.

Female Head.—Black, clad with long golden hair-like scales on the vertex, a few shorter narrow white scales and some upright white scales behind these, all the rest of the head clad with upright scales, which vary in

olour according to the direction of the light from blue-black to dark olive-rown. Basal joint of antenna black, scaled above, remaining joints black, ith a dense tuft of scales on the inner side of the second joint; verticillate airs, black. Palpi, entirely black scaled. The palpi are longer than n Barbirostris and not so heavily scaled at the base. Some specimens xceptionally shew a tendency to pale bands at the junction of third and ourth and fourth and fifth joints.

Thorax.—Prothoracic lobes black, with a tuft of dark brown scales on ne apex and some golden-brown bristles beneath these. Mesonotum, dark urple, clad with pale golden hairs. Scutellum, brown with golden hairs. Pleuræ, blackish-brown. Wings, clad mainly with dark brown scales which are mingled with pale golden scales on some of the veins. There is small pale spot on the costa at its junction with the subcosta, and another t the apex which passes on to the upper branch of the second. Lateral vings scales fusiform, broad, slightly broader than the scales on the ving of Barbirostris, fringe scales black, and there is no pale spot opposite ower branch of fifth vein and no pale fringe spot at the apex of wing. Coxæ, blackish-brown with pale hairs only. Legs, ochraceous with black cales and narrow pale bands involving both sides of the joint on the netatarsal and first two tarsal joints of fore and mid legs. On the hind egs there is a narrow pale band at the apex of tibia and metatarsus a road band at the apex of the first tarsal joint and a broad creamy band t base and apex of second tarsal joint and also the third tarsal joint, while the fourth joint is creamy at the base and black at the apex.

Abdomen.—Black, with numerous pale ochraceous hairs. There are neither scales on the genital lobes nor ventral tuft on the eighth segment.

Occurrence.—Larvæ taken from a pool within tidal influence at Port Swettenham and also in pools near Kuala Lumpur.

Remarks.—A very distinct species in some points resembling Barbirostris, but easily told from that mosquito by the broad tarsal banding of the hind leg, the absence of a pale apical fringe spot on the wing, and of a pale spot opposite the lower branch of the fifth vein. The wing has fewer golden scales than Barbirostris and the lateral scales are rather broader than in that mosquito. The scales at the base of the palpi and proboscis are not so long as in Barbirostris and the palpi are longer. The larva is evidently capable of living in water of a very high degree of salinity, the water of the pool at Port Swettenham in which larvæ were found contained 2.8 parts of saline matter (chiefly sodium chloride) in 1,000 parts. It is a very large mosquito and the larva is the most intensely black of any of this group.

Myzorhyncus Umbrosus.—*Theobald*.

Palpi, black with a tuft of long white hair-like scales on the vertex, and dark blackish-brown upright scales elsewhere. Thorax, deep brown with pale golden hairs. Wings, with only one costal spot and one small pale fringe spot where the third vein joins the costa. Legs, narrowly banded.

Female Head.—On the vertex projecting forwards between the eyes a tuft of long silky white hair-like scales, immediately behind these on either side of the middle line a few white narrow curved scales, and behind these again two or three rows of bluish-white upright scales followed by numerous

rows of dark blackish-brown or blue-black upright scales which extend back to the margin of the occipital foramen and laterally as far as the lower portions of the orbital margins. Basal joint of antenna, black with a tuft of black scales above; second joint black, about 1½ times as long as any succeeding joint and clad with clavate black scales; remaining joints, black with white downy hairs and black verticillate hairs. Palpi and proboscis entirely black scaled.

Thorax.—Prothoracic lobes very large, black in colour, and with a large tuft of black clavate upright scales on the upper angle. Mesonotum, deep brown with slate-black lines and clad on the dorsum with pale golden hairs, and on either shoulder above the prothoracic lobes is a dense tuft of upright clavate scales and on the anterior margin above the neck is a tuft of white hair-like scales. Scutellum, dark brown with pale golden hairs and bristles. Pleuræ, deep brown with black patches, clad with pale hairs. Wings clad with blackish-brown scales of the usual type. One pale golden spot on the costa at the apex where the first long vein meets it. This spot involves only the costa and first long vein. There is a pale patch of fine scales where the third vein joins the margin, the rest of the fringe being black. There are pale scales on the third vein and the fourth and fifth veins, and these branches are chiefly pale scaled with patches of dark scales where they join the margin and at the base of the second fork cell; sixth vein, pale scaled with two black patches. Legs, dark scaled with minute creamy band at the apex of femora tibiæ and first two tarsal joints.

Abdomen.—Abdomen, black with pale hairs and no ventral tuft of scales.

Occurrence.—Described from one specimen caught in the jungle near Kuala Lumpur.

Remarks.—Very like Barbirostris, but differs in having only one costal spot, no pale spot opposite lower branch of fifth vein and a much smaller area of pale fringe scales at the apex.

Myzorhyncus Separatus.

A large mosquito with a brown mesonotum, clad with pale golden hairs and dark brown shoulder tufts. Wings, with two yellow costal spots and the dark scaling of the wing field is collected into small spots the veins being for the most clad with pale yellow scales. Abdomen, clad only with hairs. Legs, minutely banded.

Head.—Black, with a vertical tuft of long silky white hair-like scales, and a few short linear scales intermixed, behind this two or three rows of bluish-white upright scales are inserted and further back rows of dark brown upright scales which extend laterally. Basal joint of antenna, dark brown with a few brown scales on its upper face, remaining joints dark brown with pale scales on the inner side of the second, downy hairs on the others, verticillate hairs, flaxen. Clypeus, dark brown. Palpi, clad with dark scales with an ill-defined ring of dirty white scales at the apex of second and third and fourth joints, the fifth joint being entirely white. Proboscis, clad entirely with blackish-brown scales.

Thorax.—Prothoracic lobes, dark brown, with dense tufts of palisade scales on the apex of each. Mesonotum varies, in some specimens being of a reddish-brown, in others, darker brown with dark slate lines or patches,

ıd with flaxen hairs and small shoulder tufts of mixed white and dark own scales. Scutellum, dark in the centre, paler laterally, clad with pale ıirs. Pleuræ, dark brown. Wings, clad with dark brown and ochraceous ales. The costa, subcosta and first long vein, clad with dark scales, except r a spot of ochraceous scales just beyond the junction of sub-costa and ısta and another where the first long vein joins the margin and a small spot the base of the first long vein which does not pass on to the subcosta or ısta; second vein with a few dark scales at the base of the stem, ochraceous ales on the rest, its upper branch entirely dark scaled except for a patch yellow scaling forming part of the second costal spot, lower branch, dark at ıex and base, pale between; third vein, pale scaled except for a small spot the base; fourth vein with a few dark scales at the base, ochraceous ones ; far as the fork cell, its upper branch with dark spot at base and apex, its wer branch with one dark spot at apex; fifth vein, with a dark spot at ; base and two on its upper and one on its lower branch; sixth, with two ırk spots; fringe, black except for a golden patch opposite lower branch of :cond and the third vein; border scales, yellow; first fork cell much longer ıan the second, its base much nearer the wing base, its stem about one-third ıe length of the cell; posterior cross vein less than its own length from ıe median. Coxæ, dark brown, clad with hairs only. Legs, clad with ark brown scales sometimes entirely without bands, but as in other :embers of this group great variety is exhibited with regard to this point, ıe specimen having basal and apical creamy bands on the metatarsus ıd first two tarsal joints of all legs.

Abdomen.—Black, with pale hairs only. No ventral tuft of scales ı the eighth segment.

Occurrence.—Bred from larvæ taken in large collections of water in the pen near Kuala Lumpur.

Remarks.—Though this mosquito has no ventral scale tuft, which is one f the marked characteristics of members of this genus, I do not think its osition here can be disputed. It may be a variety of Sinensis, though it :ems to be quite distinct from it, and the points of distinction seem ınstant. The brown mesonotum, the white apical palpal joint, and the redominance of yellow scales on the wing, are all points distinguishing from Sinensis.

Genus 5.—**Pyretophorus.**—*Blanchard.*

Head, with upright scales and a tuft of long hair-like scales and shorter ınceolate scales on the vertex. Thorax, with upright scales on the should- rs, a rosette of lanceolate scales on the anterior margin and a few narrow :ales on the dorsum. Abdomen, with hairs only, except on the genital ıbes which may be scaled. Wings, much spotted and with fusiform or luntly lanceolate lateral scales.

Remarks.—One species of this genus occurs here. It is closely related ı Myzomyia, but differs from that genus in having definite scales as well as airs on the dorsum of the mesonotum. These scales are usually narrow nd lanceolate in shape or curved. They are never broad like the scales in Nyssorhyncus, and the abdomen has no scales as members of the latter enus have.

Pyretophorus Watsonii. n. sp.

Head black with vertical tuft of long silky white and shorter lanceolat scales, with numerous rows of upright scales bluish-white in front, blac behind and laterally. Palpi, black with creamy-yellow apical band to a joints. Thorax, with golden hairs and a central line of golden scale Femora and tibiæ, spotted. Last three tarsal joints of hind leg, creamy white.

Female Head.—Black; on the vertex are a few small lanceolate scales an a tuft of long silky white hair-like scales, behind these are rows of bluish white upright scales followed by similar dark blackish-brown scales whic extend laterally. Basal joint of antenna set on an eminence, brown i colour and without scales, second joint, brown at the base, black towards th apex, remaining joints, black with dark brown verticils. Palpi, as long a the proboscis, clad with black scales, and at the apex of each joint is narrow band of creamy-yellow scales. Proboscis, black with golden-brow labellæ.

Thorax.—Prothoracic lobes, blackish-brown with black upright scale on their apices. Mesonotum, brown with patches of deep purple-brown with a tuft of lanceolate creamy scales on the anterior margin, projectin over the neck, another tuft of dark brown upright scales on either shoulde golden lanceolate scales in the centre and golden hairs elsewhere. Scut ellum with golden hair-like scales and brown bristles. Pleuræ, dark brown Wings, with blackish-brown and golden scales, the dark scaled costa broke by seven golden spots, two small ones near the base, a larger one at the ape of basal third followed by a black spot of equal size then by a yellow spo which is followed by a long black-scaled area, then a small yellow spot abou the apex of the middle third, the apical third shews two long dark-scale areas separated by a short yellow area and the apex is yellow scaled. A except the first two small yellow spots pass evenly on to the first long vein The first long vein and upper branch of second are yellow scaled wher they join the margin as is the fringe at this spot. The fringe opposite th first fork cell is black, beyond this it is golden on either side of and opposit to the junction of the third vein with the margin, and opposite the junction o the branches of the fourth vein and the upper branch of the fifth. The greate portion of the veins in the wing field are dark scaled, but there are golde scales in the following places: two spots on the lower branch of the secon vein; three patches on the third vein, two near its base, one very small near it apex; one spot at the base of the second fork cell, and one spot at the apex o each of its branches; two spots on the upper branch of the fifth, the stem an lower branch of this vein being all golden except for two small black spots three patches on the sixth vein. The scales are rather broad and fusiform in shape. First fork cell much longer than the second, its base nearer th wing base, its stem half the length of the cell. The division of the fift vein is much nearer the base of the wing than is usual, which makes the cel enclosed by its branches of unusual length. The posterior cross vein is full four times its own length from the median. Coxæ, creamy, with creamy an dark brown scales. Femora and tibiæ, clad with dark brown scales an mottled and spotted with numerous golden-yellow scales; metatarsi, mottled In fore and mid legs metatarsus and first two tarsal joints with apica creamy bands; metatarsus of hind legs with numerous incomplete golden ring

and a narrow creamy band at the apex; first tarsal joint with creamy ring in the centre and at the apex, second tarsal with a narrow black band at the apex, and beyond this point the rest of the tarsus, creamy-white, i.e., nearly the whole of the last three joints. The hind metatarsus is longer than the tibia.

Abdomen.—Black, with numerous hairs on all the segments; the eighth segment densely clad with golden hairs and possibly a few scales, but the specimen is a little mouldy and I cannot clearly make out the scales.

Occurrence.—Described from one female taken by Dr. Watson in the jungle a few miles from Klang.

Remarks.—A very distinct and easily recognised species, and the presence of scales on the mesonotum clearly point to its position in this genus. The pure white hind tarsus distinguish it from all other Malayan species except N. nivipes, and with that it could not be confused.

Genus 6.—**Nyssorhyncus.**—*Blanchard.*

Thorax, with narrow-curved and spindle-shaped scales. Abdomen, with ventral scales and also scales on the apical segments and sometimes dorsal apical patches. Wing scales bluntly lanceolate, short, some more elongate and narrow; palpi, densely scaled. Legs banded and spotted with white, the hind tarsi usually with one or more of the terminal joints pure white.

Remarks.—Four species of this genus occur in this Peninsula. I have never taken N. Maculatus, but specimens of this mosquito have been caught in Taiping. The generic characters are well marked in all the species.

Nyssorhyncus Karwari.—*James.*

Thorax, clad with narrow-curved white scales. Palpi, with four white bands. Hind legs, with broad white bands on the base of the metatarsus first two tarsal joints, base and apex of third tarsal joint, the fourth being pure white. Femora and tibiæ unspotted.

Head.—Slate-grey, with a small crescentic black patch on either side, low down a tuft of long silky white hair-like scales on the vertex, behind these some spindle-shaped white curved scales and a few white narrow-curved scales running for a short distance along the orbital margins, behind these a few white upright scales which extend laterally to the genæ and backwards to the occipital foramen. There are no flat lateral scales, though in the dry specimen some of the white upright scales may come to lie close to the head and give an appearance of lateral scales. Orbital bristles, black. Basal joint of antenna, dark brown, with a ring of small white scales which is incomplete superiorly. This joint is small and seems to be set upon a small projecting basal piece from which it is marked off by a groove; second joint thickly clad with white narrow spindle-shaped scales which are most numerous on the internal and superior faces. At the apex of the joint on its upper face are a few long white hair-like scales. Remaining joints, muddy-brown clad with numerous short silky white hairs, verticillate hairs short and silky white. Clypeus, dark brown and nude. Palpi, black scaled with creamy bands; there is one band in the middle of the second joint and another at its apex, the penultimate joint is black scaled on its basal third and

creamy scaled for the apical two-thirds, the base of the ultimate is clad with black scales, its apex with creamy scales. The black scales at the base of the palpi are elongated. Proboscis, equal in length to the palpi, black scaled with yellow apex.

Thorax.—Prothoracic lobes dark brown, with a few bristles inserted on the lobe, but no scales, though a dense tuft of spatulate scales on the margin of the mesonotum lies immediately above each of them and most probably really belongs to the prothorax. Mesonotum, slate-grey in the centre, brown at the sides, with a narrow median dark line running the whole length and ending in a triangular spot opposite the centre of the scutellum, and on either side of this there is a dark brown line which ends anteriorly internal to a dark brown oval spot about the junction of anterior and middle thirds. The scales are white narrow-curved scales arranged in lines with bare spaces between. Anteriorly there is a tuft of long white scales in the centre, and on either side just below the shoulder, immediately above the prothoracic lobes is a dense tuft of dark brown spatulate scale which stand out like palisades. Scutellum, dark brown in the centre with a grey frosting, pale muddy-brown, laterally; scales similar to the mesonotal scales; bristles, pale golden at the bases, dark brown at the apices. Pleuræ, pale brown with three rows of dark brown spots running across it horizontally, and a row of golden bristles running vertically down its centre. Wings, with costa black scaled broken by six spots of creamy-yellow scales, two near the base separated by a short black spot, the next at the apex of the basal third followed by a long black spot after which yellow and black scales alternate. The third black spot involves the first long vein, but beneath the fourth black scaled area the first vein is only involved to the extent of three small spots placed at either extremity and in the middle the intervening spaces being scaled with creamy-yellow. After this the first vein is scaled exactly as the costa is. On the wing field the black scales are disposed as follows: a small patch near the base of second vein, a few scales at the base of first fork cell, a few near the base of its upper branch, a patch exactly corresponding to the sixth black scaled area of the costa, two patches on the lower branch, one just before its centre, one at its apex, a few black scales at the base and a few at the apex of the third vein, two black patches towards the apex of the fourth vein before its division and two on each of its branches, three patches on the upper branch of the fifth and one at the apex of the lower branch and small one near the base of the undivided portion of the vein, a small spot about the middle of the sixth vein and a long area near its apex. All the rest of the wing is clad with creamy-yellow scales. The median scales where present are spindle-shaped, the lateral, narrow lanceolate. The fringe is yellow, opposite to and on either side of the termination of the veins, black between. Coxæ of legs dark brown. Fore coxæ hairy and scaled in front. Fore and mid legs black scaled on tibiæ and femora. A row of golden spines and some creamy scales at the apex of tibiæ. Metatarsus and first two tarsal joints with fairly broad apical creamy bands, these bands very slightly involve the bases of the tarsal joints, the rest of the metatarsus and tarsus black scaled. Hind legs: a few creamy scales at the apex of femora and tibiæ which are black scaled; the metatarsus and first two tarsal joints shew broad apical creamy bands, the third tarsal joint is clad with creamy scales at the apex and base, and the ultimate joint is entirely clad with creamy scales the rest of the metatarsus and tarsus being black scaled.

Abdomen.—Dark purple-brown with pale lateral translucent areas at the bases of the segments, covered with numerous tawny hairs specially dense on the apical segments. The last two segments are covered with narrow curved scales very dense on the genitalia, golden-yellow in colour.

Male Head.—The colour and scaling is that of the female. Basal joint of antennæ, large, dark brown, and as far as one can see, without scales, the second joint is very short and heavily scaled with white scales. All the joints beyond the first are translucent and of a muddy-white colour being darker at the insertion of the verticils. The two terminal joints are black and elongated. The plumes are very dense and light brown in colour. Palpi, with the first apparent joint slender, black scaled, the scales at the base long and clavate, while about the centre there is an absence of scales giving the appearance under a hand lens of a narrow band, the second and third joints are entirely black scaled beneath, above and at the sides, they are clad with snowy-white scales, the ultimate joint having a narrow black band at its base. For the rest the male resembles the female.

Occurrence.—Larvæ taken at Jugra and near Kuala Lumpur in the grassy edges of slowly flowing streams.

Remarks.—This mosquito is easily told from Maculatus and Willmori by the absence of spots on tibiæ and femora and by the different banding of the palpi and hind legs.

Nyssorhyncus Maculatus.—*Theobald.*

"Thorax slate-grey with darker longitudinal lines and snowy-white scales; abdomen black with yellowish hairs very dense apically giving the apex a distinct yellowish tinge. Legs with the femora tibiæ and metatarsi banded with pale yellow; fore and mid tarsi with narrow yellow bands, hind tarsi with very broad white ones, last joint pure white. Wings, yellow scaled, spotted with black, the costa with four large and two small basal spots; fringe, black and yellow.

"*Female.*—Head, dark brown with black upright scales behind, grey at their tips and white upright ones in front; a dense long tuft of snow-white hairs projecting between the eyes; eyes, black and silvery; palpi, black scaled, the last joint white, also the base and apex of the penultimate and the apex of the others; a few golden bristles at the apex; proboscis, deep brown, apex, testaceous; antennæ, paler brown, basal joints with white scales.

"Thorax, slaty-grey with brown longitudinal lines and a dark almost eye-like patch on each side of the mesonotum; covered with scattered flat snowy-white spindle-shaped scales, some long white scales projecting in front over the nape, and numerous golden-brown bristles in three main rows; scutellum, slaty-grey with flat white scales and golden border bristles; mesonotum, deep chestnut-brown.

"Abdomen, black with pale golden hairs which become very dense and bright golden at the apex of the abdomen; processes, black scaled.

"Legs with the femora, tibiæ and metatarsi, with broken pale creamy bands and spots; in the fore legs the metatarsus has an apical pale band, and the first tarsal an apical and basal band, the second and third narrow basal bands; ungues equal, simple, small and curved; in the mid legs the first two

tarsal joints have yellow apical bands, the last two are dark brown and unbanded; ungues equal, simple, small and nearly straight; in the hind legs the first tarsal has a broad white apical band and narrow median one, the second and third tarsal basal and apical white bands, the last tarsus pure white; the hind metatarsus longer than the tibiæ."

"Wings with creamy-yellow scales and black spots; on the costa are four large and two small black spots the latter at the base of the wing; the two apical spots are continued evenly on to the first long vein; under the third and largest spot are three black spots on the first long vein and also another beneath the fourth spot; fork cells short, the first submarginal a little the longer, but no narrower than the second posterior cell, its base nearer the apex of the wing than that of the second posterior cell, its stem nearly as long as the cell; stem of the second posterior a little longer than the cell; supernumerary cross-vein nearer the apex of the wing than the mid cross-vein and somewhat longer; posterior cross-vein more than three times its own length distant from the mid sloping towards the base of the wing; the patches of black scales are disposed as follows; one spot near the tip of each vein, a long patch at the tip of the upper branch of the first sub-marginal, another near its base and two on its lower branch, three on its stem; one at the apex and two at the base of the third long vein; one large and one small on the upper branch of the fourth and two small ones on the lower branch, one long patch at its base and another nearer the base of the vein, two moderate-sized and some small patches on the upper branch of the fifth, an apical one on the lower branch and another near the base of the fifth vein, three on the sixth vein; fringe, brown, yellow where the veins join, border scales brown also yellow where the veins join; halteres, with pale ochraceous stem and fuscous knob."

"*Male*.—Head, with more white scales than in the female; palpi, brown scaled. Apical joint much dilated, rather acuminate, penultimate joint about the same length, but much narrower than the apical joint. A patch of white scales at its apex and another at the base of the apical joint which is white on one side; proboscis thinner than in the female; apex, testaceous antennæ, brown, with deep flaxen-brown plumes, ungues small, unequal in the fore legs, the larger one twice toothed; in the mid and hind legs the ungues are small, simple and equal. Length 3.5 to 4 mm. 'Habitat, Hongkong.'"

Remarks.—This description is taken from THEOBALD's "Monograph," as I have no specimen of this mosquito. It occurs in the Malay Peninsula, as specimens have been sent from Taiping. Mr. THEOBALD states that it comes near *Myzomyia Punctulata*, but there should be no difficulty in distinguishing it from that mosquito as apart from the fact that the leg banding is very different the thoracic scaling is totally different, the mesonotum in *M. punctulata* being clothed with hairs only, while in this mosquito there are definite scales on the mesonotum.

NYSSORHYNCUS WILLMORI.—*James*.

Thorax, dark slate-grey with brown shoulder patches, the whole clad with white spindle-shaped scales. Palpi, with a narrow white band in the middle of the second joint and two equal white bands at the apex. Legs much spotted.

Female Head.—Dark brown, with the usual tuft on the vertex composed of long silky hair-like scales projecting forwards between the eyes and a few short linear scales mixed with them, behind these are rows of bluish-white upright scales succeeded by dark brown or black upright scales which pass backwards to the occipital foramen and laterally on to the genæ or cheeks. Basal joint of antenna dark brown, with a few white scales on its outer face, remaining joints dusky brown, moniliform, and clad with downy hairs and white verticillate hairs; on the second joint there are scales. Ultimate joint of palpi clad with creamy scales, penultimate, with creamy scales except for a narrow band of dark brown scales in its centre; antepenultimate creamy at the apex, brown elsewhere. A narrow ring of white scales on the apex of the second joint. To the naked eye there appear three white bands, one about the middle of the palpi and two broad equal bands separated by a narrow dark brown band at the apex. Proboscis, clad with dark scales.

Thorax.—Prothoracic lobes, dark brown with dark brown fan-shaped scales above. Mesonotum, dark brown with dark slate patches or lines thinly clad with short blunt spindle-shaped white scales. Shoulder with dense tuft of ochraceous and dark brown short clavate or almost piriform scales. Scutellum, similar in colour and scaling to the mesonotum. Pleuræ, dark brown. Costa, brown scaled, broken by two small yellow patches at the base, one at junction of basal and middle thirds, a long one just after the junction of sub-costa and costa, and another long spot just before the apex of the wing. All these spots pass evenly on to the sub-costa and first long vein, but the portion of first long vein beneath the longest brown spot on the costa (which is about the middle of the wing) is not entirely brown scaled, the brown scaling is broken by two spots of yellow scales. The rest of the veins are chiefly clad with yellow scales, the brown scales shewing as spots, there being one just before the apex of each vein, three on the stem of the second, two on its upper branch and two on its lower, three on the third vein, two on the fourth, and two on each of its branches, three on upper branch of fifth, and one on the lower branch, three on the sixth vein ; fringe, with yellow scales opposite the end of each vein ; first fork cell a little longer and narrower than second, their bases almost level, stem of first cell about half the length of the cell ; supernumerary and median cross veins quite close together, posterior about $2\frac{1}{2}$ times its own length from the median. Coxæ, dark brown with a few white scales. Femora and tibiæ of all legs clad with dark brown scales and numerous spots and incomplete bands of pale yellow and creamy scales ; Metatarsus of fore and mid legs with three broad creamy bands, one of which is apical, first two tarsal joints with broad apical and basal bands, third with basal band only, fourth unbanded; hind metatarsus very long with five creamy bands of moderate breadth, one being apical, first tarsal joint with narrow basal and broad apical band, second and third with broad apical and basal bands, fourth entirely clad with creamy scales.

Abdomen.—Blackish-brown with numerous pale golden hairs. On the dorsum of each segment after the second are a few narrow-curved scales in the centre at the apex. The number of these scales on each segment becomes progressively greater the nearer they are to the apex of the abdomen, the last two segments being completely covered with golden-brown and dark brown scales.

Male.—Head as in the female. Antennæ, with light brown joints and pale fawn-brown plumes. Palpi, with two last joints enlarged, ultimate joint, ochraceous with a narrow ring of dark brown scales at the base and on the whole ventral surface, its upper surface covered with creamy-white scales, penultimate joint scaled exactly like the ultimate, antepenultimate with dark brown scales and a narrow ring of white scales about its centre. There are the usual differences from the female in the wing, viz., shorter fork cells and less dense scaling. Fore ungues unequal, larger ungues with one (? two) teeth, smaller simple.

Occurrence.—One adult fly, caught in hut at Ulu Gombak. Larvæ taken from hill streams in jungle near Kuala Lumpur and at Jugra and "The Gap."

Remarks.—This mosquito evidently bears a strong resemblance to *Nyssorhyncus maculatus*, specimens of which have been taken at Taiping. It differs, however, in the banding of the palpi. A drawing of the palpi Maculatus is given in THEOBALD'S "*Monograph*," and shews three white bands at the apex, instead of two equal bands present in Willmori. On carefully comparing the descriptions of the two, I find besides the difference mentioned, another point of distinction in the banding of the legs. The fore and mid metatarsi in this mosquito have three broad creamy bands one of which is apical, in *maculatus* the metatarsus has only one apical band. The two first tarsal joints in *Willmori* have apical and basal bands, in *Maculatus* only the first joint has basal and apical, the second has a basal band only.

NYSSORHYNCUS NIVIPES.—*Theobald.*

Thorax black, clad with broad fusiform white scales. Palpi, black scaled with white apical bands on the second, third and fourth joints, the fifth is pure white. The last three tarsal joints and half the first joint of the hind leg are pure white.

Female Head.—Black, on the vertex projecting forwards between the eyes is a tuft of long silky white hair-like scales, and along the upper part of each orbital margin is a row of narrow-curved white scales, behind these are a few rows of white upright scales and further back numerous black upright scales which extend outwards on each side. Basal joint of antenna, black with a tuft of small white scales on its outer side, remaining joints, black with white scales on the second and third and white downy hairs on the succeeding joints; verticillate hairs, white. Palpi, clad with black scales with narrow ring of white scales on the apex of the second, third and fourth joints, the last being entirely white. Proboscis, entirely covered with black scales.

Thorax.—Prothoracic lobes, blackish-brown, clad with a few white fusiform scales. Mesonotum, black with broad fusiform white scales arranged in lines on the dorsum, a tuft of lanceolate scales on the anterior margin projecting over the neck, and a tuft of dark scales on each shoulder above the prothoracic lobes. The scales running down the middle of the mesonotum are not quite so broad as those at the sides. Scutellum, similar in colour and scaling to the mesonotum. Pleuræ, dark brown, with darker brown spots and clad with a few small white scales. Wings clothed with dark brown and pure white scales, the brown scaled costa broken by six white spots, the

second from the apex being the largest; the first long vein has a white spot beneath each costal spot and two small additional spots between the third and fourth costal spot from the base; the white scales on the first vein beneath the first costal spot are continued further along the vein towards the apex than those on the costa, there are a few white scales at the base of the first fork cell, two small patches on the lower branch of the cell, a long patch on the third vein, a small patch on the stem of the fourth and two on each of its branches; the fifth is white scaled except for a patch of black scales at its base, three patches on its upper branch and one near the apex on its lower branch; the sixth vein is alternately white and brown; the fringe has a white patch opposite the termination of each long vein and the border scales are white at the same places, being dark brown elsewhere; the cross veins are of equal length and are equidistant from one another, the supernumerary being nearer the apex of the wing; first fork cell longer, but no narrower than the second, its base nearer the wing base, its stem about two-thirds the length of the cell. Coxæ, brown, clad with a few white scales. There is a ring of white scales at the base and apex of each femur, and a large white spot on the anterior surface of the mid and hind femora, just before their apices; the under sides of the femora are silvery, above and laterally they are clad with dark brown scales. The tibiæ are clad with dark brown scales and a ring of white scales at the apex of each. In the fore leg there is a broad basal band at the apex of the metatarsus and the first two tarsal joints; the rest of these joints and the whole of the last two tarsal joints are clothed with dark brown scales; there are similar bands on the same joints in the mid leg, but they are much narrower; in the hind leg the metatarsus is clad with dark brown scales with an apical creamy band, the first tarsal joint is clad with brown scales on its basal half and beyond this the rest of the tarsus is pure white, i.e., for $3\frac{1}{2}$ joints.

Abdomen.—Blackish-brown, with dark brown hairs on the first five segments, the last three segments bear numerous scales, mostly dark brown in colour, the sixth segment has a few placed at its apex, the seventh is densely scaled on the apical half, while the eighth (and the ninth when visible) is completely covered with scales both on its ventral and dorsal surface.

Male.—The head is scaled like that in the female. The antennæ have a black basal joint a second joint dark brown at its base and paler at its apex which is covered with white scales, the remaining joints are pale fawn-brown, slightly darker at the insertions of the verticils, and the plumes under a hand lens are pale fawn-brown, but under a higher power in some lights they appear quite colourless. The palpi are black at the immediate base, coppery-bronze beyond, with patches of white scales on the upper surfaces of the last two joints. The last two segments of the abdomen are clad with numerous dark brown scales with patches of white scales on the dorsum and at the ends of the genital lobes. In other respects the male resembles the female.

Occurrence.—Bred from larvæ taken in various small collections of water in the open near Kuala Lumpur, Klang, and other places.

Remarks.—My description is drawn up from a large series of males and females. The first published description of this mosquito is that of Mr. Theobald in "The Entomologist," October, 1903, of a male sent from Kuala Lumpur, by Dr. Durham. It is a very easily recognised mosquito,

the snow-white hind tarsus distinguishing it from all other Malayan anopheles. Since writing, Dr. Watson, of Klang, has sent me a mosquito which I have named "*Pyretophorus Watsonii*," after him. This mosquito has the last three tarsal joints creamy. This is the only other Malayan anopheline with a white hind tarsus, but is easily distinguished from Nivipes by the spotted femora and tibiæ the golden thoracic sealing, etc.

Genus 7.—**Cellia.**

Thorax, with fusiform scales; abdomen more or less covered with long narrow-curved or fusiform scales irregularly disposed and with dense lateral tufts; wing scales large, bluntly lanceolate.

Remarks.—One species of this genus occurs in Malaya and it is fairly common and widely distributed. The marked feature of the genus is the lateral scale tufts. This character enables the members of this genus to be at once distinguished from those belonging to Nyssorhyncus. In other respects the members of these genera are not unlike.

Cellia Kochii.—*Donitz.*

Of a general pale yellowish colour. Mesonotum, light yellowish-brown with three dark conspicuous spots. Palpi, banded with brown and yellow and creamy bands. Legs, with spotted thighs and tibiæ. Abdomen, with lateral tufts of black scales to each segment after the first.

Female Head.—Dark brown, with long silky white hair-like scales and shorter lanceolate scales mingled together on the vertex, behind these, several rows of silvery upright scales followed by dark brown upright scales, behind and at the sides. Basal joint of antennæ, light fawn-brown with a few white scales on the upper surface; second joint pale brown, about twice as long as any succeeding joint and clad with white scales, remaining joints, pale fawn-brown with darker rings at the bases and silky white verticillate hairs. Palpi, clad with dark brown scales at the base and a ring of white scales at the apex of the second joint; third joint with a few dark brown scales at the base followed by a band of golden-yellow scales and a ring of white scales at the apex, fourth joint, brown at the base, golden-yellow in the middle, and white at the apex, fifth joint, dark brown at the base and golden-yellow at the apex. Basal half of proboscis, dark brown, clad with dark brown scales broken by incomplete bands of golden scales, apical half, golden-yellow with in some specimens, an incomplete black band at the base of the labellæ.

Thorax.—Prothoracic lobes black, clad with golden scales. Mesonotum pale yellowish-brown with a silvery frosting on either side, and about a third of the total length from the anterior margin is a dark brown eye-like spot and there is a similar spot at the base of the scutellum; on either shoulder is a tuft of creamy-yellow lanceolate scales, and between these on the anterior margin is a tuft of white linear scales; the rest of the mesonotum is clad with pale yellow hairs and a line of white clavate scales on either margin. Scutellum, dark brown in the centre, pale yellowish-brown at the sides, clad with narrow white scales and golden-brown bristles. Pleuræ, brown, with dark brown patches. Wings, clad with dark brown and golden-yellow scales; in the centre of the costa just before the subcosta joins it, is a large area covered with dark brown scales and on the basal side

f this are four dark brown spots separated by areas clad with yellow scales, nd on the apical side of this large spot is first a long yellow spot, then a rown spot, then another yellow spot, followed by a brown spot, succeeded y a yellow spot which extends to the point of junction of upper branch of ne first fork cell with the margin. Beginning at the apex the first long ein has brown scales beneath the first dark costal spot and under the next re two small brown spots separated by yellow, and beneath the large central ark costal spot, the first vein shews dark spots separated by yellow, and on ne basal side of this there are two small black spots the rest of the vein eing yellow scaled. All the rest of the veins are clad with yellow scales ith black spots as follows, two on the stem of second vein and two on its ower branch, one at the base and one near the apex on the third vein, two on he stem of the fourth and two on each of its branches, one at the base of the fth, three on its upper branch and one on the apex of the lower branch, and hree on the sixth; fringe yellow opposite junction of each vein with the argin; first fork cell a little longer than the second, its base nearer the apex f the wing, its stem about as long as the cell; posterior cross vein a little ore than its own length distant from the median. Coxæ, ochraceous with ale scales and bristles. Femora and tibiæ, clad with dark brown scales ith numerous yellow spots; metatarsus of fore leg with yellow spots and road creamy apical band. First two tarsal joints with creamy bands at pex and base and an additional median band on the first; third tarsal joint ith a creamy basal band; fourth tipped with yellow. Metatarsus of mid leg ith yellow spots and first two tarsal joints with narrow apical bands. In he hind leg the metatarsus has numerous yellow spots and a narrow reamy-yellow apical band. The first tarsal joint has a broad creamy apical and and the third and fourth are clad with creamy scales at base and apex, nd dark brown scales in the middle; last joint, dark brown at the base, reamy-yellow at the apex. Ungues, equal and simple.

Abdomen.—Dark brown, clad above with golden-yellow scales and hairs hich become very dense on the apical segments, completely clothing them. eneath, on either side of each sternite from the second to the seventh inclusive here is a * tuft of dark brown erect clavate scales which stand out like mall rosettes, the venter of the eighth segment is clad with golden scales.

Male.—Head as in the female. Proboscis entirely clad with golden-ellow scales except for three narrow rings of dark brown scales on the basal alf. The last joint of the palpi is clad with yellow scales, the penultimate oint is yellow with a narrow dark ring at the apex, the antepenultimate joint as a band of dark scales at its base and a narrow band about its centre and nother at its apex, the portions between, being clad with golden-yellow cales. The antennæ are golden-brown with golden-brown plumes. The ore ungues are unequal, the larger having one tooth or possibly two. Mid and hind ungues equal and simple.

Occurrence.—In roadside puddles or any large collection of water in the pen the larvæ of this mosquito may be found. It is more abundant in the icinity of houses.

Remarks.—A very beautiful anopheline and apparently widely distri-uted in Malaya. The colour of the scaling differs considerably in the pecimens from different localities.

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* Note.—These tufts of scales really are attached to the venter on each side of ne midsternal line. They diverge and, in the dried specimens, this divergence is so great s to give the appearance of lateral tufts.

Sub-Family **MEGARHININAE.**—*Theobald.*

Characters.—Large brilliantly-coloured mosquitoes with curved pro boscis. Palpi in the male always long, acuminate and 4-5 jointed. Hea clad entirely with large spatulate scales and upright forked scales confine to the nape. Thorax with fusiform, elliptical and spatulate scales Scutellum with spatulate scales only. Larvæ carnivorous usually feedin on the larvæ of other mosquitoes. Eggs laid singly with hard she and acuminate ends.

Remarks.—In Vol. III. monograph of "The Culicidae of the World. F. V. Theobald, 1903, this sub-family contains two genera Megarhinu and Toxorhynchites. In the "Genera Insectorum" 26*me* fasciculo 1905, the genus Toxorhynchites has been removed from the sub-famil Megarhininae and placed in a new sub-family Toxorhynchitina containing the one genus Toxorhynchites. The sub-family Megarhinina now contains only those species in which the female palpi are nearly a long as the proboscis and the new sub-family Toxorhynchitinae contain all the species formerly in the sub-family Megarhininae in which th female palpi are less than half the length of the proboscis. Th division Megarhininae into two sub-families seems in accordanc with the general scheme of classification used by Theobald, but I hav not followed it as I do not think the character upon which the sub division is founded of more than generic value. It is true the four grea sub-families of the Culicidae are founded on differences in the length o the palpi in different species in male and female, but it is not a natura subdivision but one merely of convenience for no one can doubt classification which places such allied genera as Culex and Mehanoconion and Aedes in different sub-families is arbitrary. It seems to me nothin is to be gained by a further subdivision especially as Theobald Toxorhynchitinas contains species with palpal differences as great a those between his Megarhininae and Toxorhynchitinae. I have therefor retained the sub-family but have created a new genus to receive thos species which come neither into Megarhinus or Toxorhynchites.

Synoptic Table of Genera.

(*a.*) Palpi in the female long, nearly as long as those in the male. Caudal tuft present.....*Genus* 1.—Megarhinus.

(*b.*) Palpi in the female less than ½ the length of the proboscis, 5-jointed. Caudal tuft usually present. Mosquitoes of heavy build and densely scaled .... *Genus* 2.—Teromyia.

(*c.*) Palpi in the female not more than a quarter the length of the proboscis, 4-jointed and slender. Caudal tuft absent. Mosquitoes of lighter build than those of the preceding genus.....*Genus* 3.—Toxorhynchites.

Genus 1.—**Megarhinus.**—*Robinean-Desvoidy.*

Note.—This genus is unrepresented in Malaya.

Genus 2.—**Teromyia.**—nov. gen.

Head with large broad spatulate scales and a few upright scales ehind. Proboscis very long and curved. Palpi five-jointed (the two last oints are very small), about one-third the length of the proboscis. Wings vith an extra cross vein near the base joining the sub-costa and first ong vein and with very short fork cells, the first much smaller than the econd; median cross-vein considerably nearer the base of the wing than the upernumerary, posterior cross-vein sometimes placed to the apical side f the median. Lateral tufts of erect hairs generally present on the last wo abdominal segments. Colouring metallic.

Remarks.—In Theobald's monograph it is stated that in members of his genus there are no upright scales on the head. There are always pright scales on the nape, but in a dried specimen these may be concealed y the thorax if the head is drawn up against it by retraction of the neck. nother point that appears to have escaped notice is the presence of an xtra cross-vein which is present in all my species; it runs from about the niddle of the sub-costa to the first long vein; there is also a false vein nscaled running between the fifth and sixth. This is a real vein and not mere fold in the wing. Five species are here described, and they are all pparently new species, though it may be T. Quasiferox may prove to be nerely a variety of M. Ferox or Immisericor.

Teromyia Acaudata. n. sp.

The following description is from a fresh specimen. The colours were ar more brilliant then than in the dry specimen. Mesonotum dark bronze-reen, almost black to the naked eye with margin scaled pale golden and pple-green, in some lights azure-blue, shoulders silvery. Prothoracic lobes vith silvery, azure-blue, and apple-green scales. Scutellum apple-green. egs rose-purple, with two white bands on the mid legs and one at the base f the first tarsal joint on each hind leg. First segment of abdomen deep lue in the centre, golden-yellow at the sides, remaining segments royal-urple on the dorsum with creamy-yellow (silvery in some lights) lateral pots. The venter scaled creamy-yellow with a band of purple running down he whole length in the centre.

Female Head.—Black, clad behind the eyes with scales which are blue nd green, at one time appearing blue, again with a slight change of posi-ion apple-green while the scales behind are dark coppery-purple, but turn he head against the light and the scales on the orbital margin become eacock-blue with an edging of rose-red, while the rest of the scales are dark ronze-green; there are dark brown upright scales behind; vertical and rbital bristles dark purple. Basal joint of antenna black, thickly clad vith small silvery scales above and to the inner side, and with a downy

silvery tomentum below, these scales are very difficult to see in the dried specimen as they lose their metallic lustre and take on the colour of their background. Remaining joints black, the second having black scales inserted all round its basal half; verticillate hairs dark purple. Palpi more than one-fourth, less than one-third the length of the proboscis with three evident joints, but on removing the scales the palpi are seen to consist of five joints. The scales are for the most part coppery-purple, though in some lights a patch of peacock-blue scales is to be seen on the upper surface of the apex of the second joint. Proboscis rich coppery-purple but this may change to deep bronze-green or dark peacock-blue with a change in the direction of the light. In fact the change of colour produced by change of position is beyond description.

Thorax.—Looked at from above under a hand lens the prothoracic lobes are bright peacock-blue, but seen sideways the scales are of mixed colours, silvery apple-green and peacock-blue the predominant colours being bright peacock-blue. Mesonotum in a good light under a hand lens seen from above is dark bronze-green over the greater part of its surface shading at the margins into beautiful golden and apple-greens with bright peacock-blue patches over the wing roots and on the front margin just over the neck, the scales on the shoulders behind the prothoracic lobes are silvery the scutellum in most lights is clad with apple-green scales with some peacock-blue intermingled. Pleuræ dark purple-brown, clad with metallic silvery scales. Wings brown, with marked iridescence clad with rich coppery purple scales, median cross vein very short about three times its own length from the supernumerary and nearer the base of the wing, posterior cross vein with a double curve commencing to the side of the median cross vein nearer the wing apex, in length about twice that of the median. Coxæ dark brown clad with silvery scales; fore femora clad above, at the sides and on the apical half of the ventral surface with rich purple and coppery scales, on the basal half of ventral surface with pale golden scales, mid femora similarly scaled above and at the sides, but clad with pale golden scales on the whole of the ventral surface, hind femora with golden scales beneath, and laterally on the basal half, elsewhere purple scaled; knee spots of all legs pale rose-red or white; tibia and tarsus of fore leg coppery purple or deep royal-purple in some lights; the other legs are similarly scaled, but show white bands as follows: at the base of the metatarsus and first tarsal joint of the mid leg and at the base of the first tarsal joint of the hind leg.

Abdomen.—Dorsally clad with scales which appear rich royal-purple or coppery-purple according to the direction of the light and with creamy-yellow basal lateral spots. The venter shews a purple band in the centre and creamy-yellow bands on either side of this. When the abdomen shrinks in drying the lateral spots may disappear or appear as part of the yellow banding on the venter, but in the fresh specimen they are very conspicuous.

Male.—The male plumes are dark steel-grey. The palpi are coppery-purple with paler scales at the apices of the second and third joints. The bands on the legs are practically absent only the merest trace appearing on the under surface of the base of the first tarsal joint of the mid and also of the hind leg.

Occurrence.—I am indebted to Dr. Finlayson of Singapore for the pecimens of this mosquito. They are all bred from larvæ found in pitcher lants in the neighbourhood of Singapore.

Remarks.—It is a very distinct species and when fresh a very beautiful nosquito the purple of the abdomen being magnificent but the colours fade erribly when dry. In some respects it resembles *M. ferox*, but the bsence of the caudal tuft the total difference of the cross veins of the wing nd the bright purple abdomen distinguish it at once. Though there is no audal tuft the build of the insect and the five-jointed palpi prove it to belong o this genus rather than Toxorhynchites. In some respects the mosquito esembles *M. purpureus*, but the female palpi have no resemblance to those igured by Theobald as those of *M. purpureus*. The cross veins also differ n *M. purpureus* from these specimens and the leg banding in the mid legs is n the metatarsus and first tarsal joint in *T. Acaudata* whereas in *M. purpureus* it is on the first two tarsal joints.

Teromyia Quasiferox. n. sp.

Thorax black with brilliant metallic bronze-green fusiform scales n the dorsum, on the margin a broad stripe of scales varying in colour vith the light, from azure-blue to apple-green and at times almost ilvery-white and over the wing roots patches of bright peacock-blue spatu- ate scales with similar scales in front of the scutellum; some of the pecimens shew an ill-defined bluish central stripe. Scutellar scales varying rom bright apple-green to peacock-blue. Head with bronze-green scales vith a margin of silvery scales along the eyes edged behind with peacock- lue and laterally swelling into a small patch of silvery or pale green scales. Palpi purple with violet and rose tints above at the apex, and at the apex f the second joint. Legs much banded in the female. The whole tibia of nid leg except the extreme apex golden scaled. Metatarsus golden with a ale green apex; tarsal joints white. Knee spots of all legs peacock-blue. Abdomen with first segment apple-green, second segment bronze-green, emaining segments steel-blue; caudal tuft orange and black.

Female Head.—Black, clad with large bronze-green spatulate scales; long the eyes is a silvery margin edged behind with peacock-blue scales pecially well seen on the vertex, so that passing backwards from the eyes ou have first silvery scales then a margin of peacock-blue merging into the ronze-green. In certain lights all the bronze-green look peacock-blue and the ilvery orbital margin takes on a beautiful rose-pink. Right back in front of the nargin of the occipital foramen are three or four rows of dark brown upright orked scales difficult to see unless the head is flexed. Basal joint of antenna lack, densely clad with small piriform silvery scales, second joint brown, with lark brown scales at its base, and some dark brown hairs; remaining joints rown, thickly covered with downy hairs and dark brown verticils. Palpi bout one-third the length of the proboscis, five-jointed; first joint small, bout as broad as long, second twice the length of the first, enlarged apically, hird as long as the two preceding, and the fourth and fifth of nearly equal size nd like two beads on the end of the third but quite distinct joints. Only the unction of second and third can be plainly seen when the scales are on.

The palpi are clad with metallic purple scales but on the upper surface of th apex of the second joint the scales are bright rose-pink and on the apex of th palpi the scales are rose-pink and violet. Proboscis long, clad with scale which shew bronze-green metallic-purple and rose-purple tints with a fe scattered peacock-blue scales.

Thorax.—Prothoracic lobes black entirely covered with flat scales In one light the upper half appears bright apple-green the lower silvery but change the position of the specimen and the green becomes peacock blue. Mesonotum black densely clad with flat spindle-shaped, elliptica and large spatulate scales, the last being chiefly at the margin over th roots of the wings. The scales on the dorsum are metallic bronze-gree while on either side there is a broad stripe of scales which appear silvery silvery-green or pale apple-green or even peacock-blue as the direction o the light changes. In the centre is a broad stripe of bluish scales very ill defined and only seen in certain lights; silvery patches on the shoulder are present, and over the wing roots the scales are peacock-blue. Ther is a well-marked row of bristles on each prothoracic lobe dark brown i colour and there are tufts of mesonotal bristles over the wing roots and i front of the scutellum. Scutellum clad with flat scales a mixture of pal yellowish-green and peacock-blue. Pleurae black densely clad with silver scales. Wings with scales which where massed appear bronze-green o peacock-blue; fork cells short, cross veins as follows:—Supernumerar about as long as the mid and distant from it three times its own length posterior cross vein twice as long as median set obliquely and lying to th apical side of the median; scales small and spatulate. Coxæ black, quit covered with brilliant silvery scales: all the femora creamy-yellow below brilliant purple and rose-purple above and laterally, with a ring of scales o the apex of each which is rose-pink, azure-blue or silvery-white in differen lights; fore tibia with metallic purple scales mottled with peacock-blue On the under or hinder side (I am not sure which as the leg is twisted) o the apical half the scales are a mixture of pale green and azure-blue t silver-white; metatarsus creamy-white, tarsal joints dark purple; mid tibia entirely clad with metallic-golden scales mingled with some azure-blue an pale yellowish-green scales, the apex being clad with dark purple scales metatarsus with similar scales golden-yellow to the naked eye and unde a hand lens greenish-yellow and azure-blue scales are intermingled; firs three tarsal joints with pearly-white scales, black spines and golden-yellow tips, last tarsal joint golden-yellow; hind tibia golden-yellow beneath, darl rose-purple at the apex above, and elsewhere a mixture of azure-blu yellowish-green and purple scales; metatarsus basal half golden-yellow apical half rose-purple, first tarsal joint, basal half creamy with azure-blu tints, apical half dark rose-purple, remaining joints rose-purple. Ungue equal and simple on all the legs.

Abdomen.—First segment entirely covered dorsally with scales whicl are a mixture of pale greens and yellowish-greens, second segment darl bronze-green, remaining segments dark velvety-purple, when fresh, steel blue. Laterally there are to each segment two creamy-yellow bands on broad (this is only seen in the fresh specimens) above and the other narrow below it, separated by a thin line.

Male.—There is considerable variation in different specimens, especially as to the amount of banding on the legs and the ornamentation of the palpi. In one specimen, the palpi are scaled as follows: ultimate joint dark purple with coppery and bronzy reflections; penultimate joint dark purple with a long patch of bright peacock-blue beneath and a spot of peacock-blue on the inner side of the apex and a row of long black spines on the outer side and short ones on the inner side; antepenultimate joint, silvery-white at the base above, then dark purple then azure-blue, while beneath it is dark purple for the basal two-third creamy-yellow beyond; the basal joint is almost entirely white above, dark purple beneath. The peacock-blue scales in some direction appear brilliant mauve or rose-purple. In fact the changes of colour defy description. The thorax is bright coppery with a median bronze-green stripe and broad azure-blue margins. The basal joint of antenna is black, but instead of being densely clad with silvery spatulate scales as in the female it has a thick tomentum of silvery down which makes it appear brilliant glistening white; second joint heavily scaled with metallic scales coppery-green, apple-green, dark brown, peacock-blue, all of which colours can be seen, remaining joints brown with dense rich olive-brown plumes. The legs for the most part rich royal-purple, but the thighs are scaled with numerous pale apple-green, coppery, and golden-green scales; at the knees is a spot of scales which changes colour from snowy-white to peacock-blue or pale golden-green; under sides of thighs golden; on the metatarsus and first tarsal joints of mid legs there is a partial band which does not show on the upper surface, it is snowy-white, pale-green or peacock-blue, according to direction of light; hind legs have a better marked similar band on tarsal joint. Fore and mid tongues unequal, larger toothed.

Remarks.—Mr. Theobald, to whom a specimen of this mosquito was sent, suggests that it is probably *Megarhinus Immisericor* first described by Walker and in his recently published Vol. III. he has placed *M. Immisericor* in the genus Toxorhynchites. He does not seem to have described the female. If this is *M. Immisericor*, I am at a loss to understand how it can be placed in the genus Toxorhynchites as the palpi are distinctly five-jointed. As mentioned in the remarks on the generic characters I do not think the separation of Toxorhynchites from Megarhinus is based merely on the palpi though this is the only character given by Theobald, but even on that ground alone this mosquito would be excluded. It now comes in Teromyia.

Some specimens sent me by Dr. Finlayson from Singapore bred from larvae found in pitcher plants varying somewhat from the type described are probably only this mosquito. The mesonotum is clad with scales of a peculiar shade. It is a dead colour and old-bronze would best describe it. One specimen shews a peculiarity, on one side is an irregular patch which under a lens looked as though it was a denuded portion, but under higher powers it is found to be covered with dark purple-black scales. The males also differ in the scaling of the first abdominal segment, for in the type apple and golden-green is the colour of the scales here, but in the Singapore specimens the segment is clad with deep blue scales in the middle and bright golden-yellow scales on either side and the lateral abdominal spots are deep yellow and not

silvery-white as in the type. Some specimens I bred from larvæ take in the water collected in a fallen leaf of the Nebong palm in the jung at Jugra also shew variation from the type. The band on the hind le is much more marked and passes completely round the joint. Th mesonotal scales are of a brighter metallic green, the spot on th upper surface of the proboscis is a long patch of golden-green scale instead of a small patch. It is an exceedingly handsome mosquito and o the whole the largest of the Malayan species. As the position of cros veins of the wing in this genus appear to be remarkably constant, it woul be possible to diagnose this mosquito from the wing above as the seve Malayan species I have differ from each other in this respect.

Teromyia Magnificus. n. sp.

Thorax, brilliant metallic-green with bluish-green margins. Head cla with bronze-green scales and marginal scales with azure-blue and rose-purpl tints. Pleuræ, thickly clad with silvery-white scales. Proboscis and palp rich rose-purple. Legs, rose-purple, with gold and silver scales on th under sides of femora and azure-blue knee spots and a band on the mid an hind tibiæ about the centre, varying from cream to silver or azure-blu in colour, according to the direction of the light ; a similar band i present close to the base of the metatarsus of the mid and hind legs an also at the base of the first tarsal joint. Abdomen covered above wit coppery-bronze scales, except the first segment which is clad with scales o a brilliant apple-green, second and third segments with a band of the sam scales and broad triangular lateral spots, fifth and sixth with white latera spots, caudal tuft, white and black with a few orange hairs at the tip.

Female Head.—Black, under a hand lens peacock-blue scales on th vertex, a large central patch of bronzy-green and pale bluish-white scale along the orbital margins broadening out laterally into patches. In whateve direction one looks at the blue scales there is always seen a sort of margi of rose tints which becomes very distinct if the head is looked at sideways There are a few dark brown almost black upright scales on the nape orbital and vertical bristles black. Basal joint of antenna black, with smal flat scales on all sides except the outer, laid in an imbricate manner and i most lights taking the colour of their background, though dark blu reflections are present in a good light, second joint dead black with dusky spatulate scales on the outer side at the base and a tomentum of downy colourless hairs and some long black hairs inserted amongst the scales, bu no true verticillate hairs ; remaining joints, dead black, colourless at th immediate insertion of the verticils clad with downy colourless hairs verticillate hairs, black. Clypeus black, with a dark grey tomentum Palpi, about one-third the length of the proboscis, clad with metalli rose-purple scales and a few golden ones at the tip. Proboscis clad wit metallic rose-purple scales.

Thorax.—Prothoracic lobes black, entirely covered with flat scales which are peacock-blue or in some lights, delicate rose. Mesonotum black clad with large scales which are spatulate, elliptical, and fusiform, the spatulate scales forming broad marginal bands. In the living specimen

nder a low power hand lens with plenty of light the predominant colour a bright metallic-green like a green bottle fly with margins of bronze and ople-greens mixed. After death this colour changes considerably, the reater part of the mesonotum appearing of a rich bronze-green while the argins shew peacock-blue with rose tints on the shoulders and over the ings and the margin between shewing shades of green and blue mixed; esonotal bristles, black. Scutellum, thickly clad with large spatulate cales with truncated ends which appear golden or bronze-green according the light, now one colour predominating, now the other, now the two olours intermingling; bristles, black. Pleuræ black, entirely covered with lver-white flat scales. Wings, clad with scales which shew bronze-green nd purple tints; subcostal and first vein with double row of large spatulate edian scales and a few lateral on their anterior edges; third vein scaled for me distance on the basal side of the median transverse; supernumerary ross vein about five times its own length from the median transverse nd on its apical side, posterior transverse shews a double curve and is istant from the median (being placed to the apical side of that vein) by bout half its own length. Coxæ, brownish-black clad with silvery-white at scales; fore femora, clad with purple-bronze scales for a short distance t the base then comes a broad band occupying nearly half the total length f the femora of scales which vary from pale golden to creamy-white, with a atch of peacock-blue towards the apex of this band on the upper surface. hese light scales continue further along the femora on the ventral surface han they do on the dorsal; remainder of femora, purple-bronze. The mid emora are clad with purple-bronze scales with peacock-blue tints except on he ventral surface which is clad with pale golden scales, the hind femora re clad with pale golden scales except for a small ring of purple scales at he base and on the apical third of the dorsal surface; mid and hind femora hew a ring of creamy-yellow scales at the extreme apex: all the femora ave three rows of short black spines. Fore tibiæ and tarsi are clad with ose-purple scales and the only sign of banding on the tibia is about three hite scales situated in the centre of the ventral surface; mid and hind ibiæ shew a band in their centre which is pale golden or creamy-yellow or ilvery-white according to the light and is broader on the mid tibiæ; the asal half of the mid metatarsus with white scales except just at the base, he white band on the hind metatarsus is about its own breadth from the ase, the remainder of each metatarsus is purple scaled; the first tarsal joint n mid and hind legs also shews a white band close to the base; ungues qual and simple.

Abdomen.—First segment dorsally clad with brilliant greenish-blue cales. In some lights these scales are bright apple-green, in others there is nore of blue in them; the sides of the segment are clad with silvery-white cales. The second and third segments have narrow basal bands of apple-reen scales, the rest of the dorsum being clad with brilliant coppery-ronze scales. At each side of each of the two segments is a triangular atch with its apex towards the apex of the segment; this patch is made up f two distinct patches, the basal patch is apple-green, the apical and lower atch is silvery-white. The fourth segment has no basal band and the lateral pot is reduced to a few apple-green scales at the base and a very few white nes at the apex, the fifth and sixth segments shew large white lateral atches and long silky white hairs forming the commencement of the

caudal tuft, seventh and eight segments shew no spots, but long black later hairs continuing the caudal tuft, the terminal segment has inserted on i end, not on its side, some orange hairs. Ventrally, the second, third, fift and sixth segments are silvery scaled, the remaining segments being cla with dark bronze scales.

Male.—The male has plumose antennæ, banded brown and white wit dark brown plumes; the second joint is slightly enlarged at the bas and heavily scaled. Palpi damaged; they are purple scaled for the firs three joints, except for a creamy band on the first joint near its apex; fina joint knocked off. The mid leg shews but a trace of the banding seen i the female, there being a few white scales on the under surface of the middl of the tibiæ and the under surface of the metatarsus near the base; in th hind leg there is a band of white scales in the middle of the tibiæ, but it doe not appear on the dorsal or outer surface; the same traces exist on th metatarsus and first tarsal joint. In all other respects as to scaling the mal resembles the female. The genitalia are apparently very simple th claspers being composed of a basal piece with simple hinged hook at th end. The (first) larva of this mosquito (for I have never taken the adult) wa found at Gombak in the water collected in a bamboo stump. At Buki Kutu they seem to be less rare and apparently they affect rather the wate collected in a living bamboo which has been perforated by an insect than bamboo stump which is open at the top or a split fallen bamboo.

Occurrence.—Bred from larvæ obtained in the water collected in livin bamboos which have been pierced by an insect borer, the only entrance t the water being through the small hole thus made.

Remarks.—In some respects this mosquito resembles *M. splendens*, bu in that mosquito no mention is made of scales on the basal antennal joint there are creamy scales on the second joint instead of dark brown, the super numerary cross vein is much nearer the mid cross vein in *M. splendens* and the femora and tibiæ are golden scaled. Again in splendens, no mention i made of the triangular golden-green lateral spots on the abdomen which i a very marked feature in Magnificus. T. Raris also resembles this mosquito in many points.

Teromyia Raris. n. sp.

Thorax black, clad with rich metallic bronze-green scales with, in some lights, an ill-defined central line of blue; azure-blue patches on the shoulders and over the roots of the wings. On the anterior half the marginal scales are more of a yellowish-green and form a more or less well-marked marginal band but not nearly so well marked as in Magnificus. Head with yellowish-green scales, edged with rose-pink along the orbital margins. Palpi with one narrow silvery band at the apex of first joint. First segment of abdomen pale golden green, remaining segments rich coppery-bronze with pale green lateral spots. Hind femora azure-blue above and creamy-yellow below, except at the apex where they are purple. A creamy band in the centre of the hind tibia which does not shew on the outer face. Caudal tuft, silvery-white and dark purple-black.

Male Head.—Clad with yellowish-green and light bronze-green scales with an edging along the orbital margin of scales, which under a hand lens are rose-pink and on the vertex behind these are peacock-blue scales succeeded by the green, and a few rows of very narrow upright forked scales, dark brown in colour, behind; vertical and orbital bristles, dark brown, almost black. Basal joint of antenna, black with silvery-grey tomentum without scales, second joint, dusky brown, clad with metallic scales not very many and only on the inner face, the joint being about 1½ times as long as the succeeding joints except the last two, remaining joints whitey-brown below the insertion of the verticils and dark brown above; verticillate hairs, purple-brown. Clypeus black with silvery-grey tomentum. Palpi four-jointed, there may be a small basal joint which would make them five-jointed, but this can only be determined by dissection, so I speak of the joints as four, meaning the evident joints that can be seen without dissection. First joint clad with metallic-purple scales on its basal two-third and silvery-white on the apical third, second joint nearly twice as long as the first, clad with dark purple scales, except on the upper surface of the apical two-thirds where the scales are lighter and more of a dark rose-pink, remaining joints, dark purple.

Thorax.—Prothoracic lobes entirely covered with scales which shew peacock-blue, azure-blue, and in some lights, rose and violet tints are mingled with the blue. Mesonotum, clad on the anterior margin above the neck with scales which are peacock-blue, behind these, above the prothoracic lobes, there is a band of golden-green scales and below these behind the prothoracic lobe, but still on the mesonotum and not on the pleura is a patch of silvery scales; the band of golden-green scales merges over the wing into peacock-blue; the rest of the mesonotum is densely clad with dark bronze-green scales and in some lights there is an ill-defined blue central band. Scutellar scales are bronze-green in the central lobe and a mixture of golden-green and peacock-blue on the lateral lobes. Pleura, black with silvery scales. Wings with bronze and golden-green scales; third long vein scaled for a considerable distance on the basal side of the transverse veins; supernumerary and median cross veins of about equal length and the median lies to the basal side of the supernumerary and distant about five times its own length from it; the commencement of the posterior cross vein is just to the apical side of the median. Coxæ, blackish-brown, with silvery scales; femora clad with metallic-purple scales above and laterally, and creamy-yellow scales below. The creamy scales are only on the basal two-third of the fore femora, but on the hind femora they spread on to the sides, and above the scales are more peacock-blue than purple. All these scales shew blue tints and even greenish-yellow as the position of the insect is changed, but violet and purple are the predominant colour on the fore and mid legs, while peacock-blue is the predominant colour on the hind femora. Remainder of all legs clad with metallic-purple scales. A ring of silvery or pale blue scales at the apices of the femora. In the centre of the hind tibia is a band of silvery scales beneath and at the sides, but not on the outer surface.

Abdomen.—First segment clad with rich golden-green and yellowish-green scales with silvery patches below, second segment, rich coppery-bronze with pale green lateral spots, remaining segments dark purple-bronze with traces of blue lateral spots, but owing to retraction in

drying this is uncertain. On the sixth segment are some long silky whi hairs which form the beginning of the caudal tuft which is continued on th seventh and eighth segments with purple-black hairs.

Occurrence.—Described from one male bred from a white larva taken i the water collected in a bamboo in the jungle at Ulu Klang. The larv was carnivorous as are all the larvæ of this sub-family and was creamy white.

Remarks.—I have no female and as I have only taken one other larva o this species which died, I presume it is a rare insect. It is a very distinc species and the position of the cross veins would at once distinguish i from all the other Malayan species of this genus described. At first sight i closely resembles *T. magnificus*, but the position of the cross veins is differen in the two species for in Magnificus the posterior cross vein is straight an lies a little to the basal side of the median, whereas in Raris the posterio cross vein is s-shaped and lies to the apical side of the median. The hin legs in *T. Raris* only shew one imperfect band on the tibia, while i *T. magnificus* there are three bands on the hind legs.

Teromyia Funestus. n. sp.

Thorax dark purple-brown with dark bronze-green scales on th dorsum and margins of golden-brown and golden-green scales. Prothoraci lobes and the shoulder above them clad with peacock-blue scales. Hea with dark bronze-green scales edged with peacock-blue. Palpi and pro boscis dark purple-black. Legs clad with purple scales with peacock-blu and dark blue scales intermingled. Partial basal band on the first tarsa joint of the hind leg. Abdomen, dark purple with peacock-blue latera bands and purple-black caudal tuft.

Male Head.—Entirely clad with dark bronze-green scales, edged with peacock-blue scales along the orbital margins, and black upright forked scales behind. Basal joint of antenna black and nude without a well marked tomentum and relatively small, second joint enlarged and densely scaled with dark almost black scales, remaining joints dusky brown, each joint getting longer and thinner as they approach the apex of the antenna. The plumes are much longer at the base than the apex which is unlike the condition present in the other Teromyia I have. This is only on the outer side of the antenna. The colour of the plumes is purple-brown. Clypeus black and frosted. Palpi very small for a Teromyia, all the four joints beyond the small basal joint are of about equal length and are clad with dark purple scales which in some lights look almost black. Proboscis rather short, clad with purple-black scales.

Thorax.—Prothoracic lobes entirely covered with flat spindle-shaped peacock-blue scales. Mesonotum, purple-brown, covered with dark bronze-green scales on the dorsum; in front above the prothoracic lobe of each side is a patch of peacock-blue scales and behind the prothoracic lobe of each side a patch of silvery scales, the scales at the margins are coppery-green and golden-green and they form an ill-defined broad golden-green and brown band on the side. Scutellum, clad with coppery and golden-green scales. Pleuræ, purple-brown with silvery scales. Wings, with scales which are rich coppery-bronze, except at the base where there are golden-green and

rown scales; posterior cross vein commencing almost in a line with, but little to the apical side of, the median cross vein; fork cells, short. Coxæ lack, clad with silvery scales; thighs rich purple above and at the sides, but eneath the scales are pale, in some lights silvery-white, but in certain ghts shewing the most brilliant iridescent colours, blues and greens; the emainder of all the legs brillant purple, the only attempt at banding being n imperfect band on the first tarsal joint of the hind legs. This is only een below and at the sides. Fore and mid ungues unequal, the larger miserrate.

Abdomen.—First segment clad with greenish-yellow metallic scales, emaining segments clad above with rich velvety-brown scales, almost lack; owing to shrinking, it is little difficult to say what the lateral ornanentation consists of, but the first segments have distinct pale metallic ellowish-green lateral spots, and I believe these are present on all the egments, though they are hidden on the apical segments. There are also hite spots below these, and at the base of the caudal tuft there are eacock-blue patches; the venter is clad with velvety dark brown scales xcept on the third, fifth and sixth segments which are entirely scaled ilvery-white. The caudal tuft is black in some lights, rich purple-bronze n others.

Occurrence.—Described from one male bred from a pupa taken in a amboo in jungle about six miles from Kuala Lumpur.

Remarks.—Evidently a rare species, and it is to be regretted I have no emale. To the naked eye it is a very funereal looking mosquito, some of he more beautiful colours are only seen with a lens.

Genus 3.—**Toxorhynchites.**—*Theobald.*

Characters.—Head entirely clad with spatulate scales with a few upright scales confined to the nape. Thorax with fusiform, elliptical, and spatulate scales. Female palpi about one-sixth the length of the proboscis four-jointed and rather slender. Caudal tuft absent. Mosquitoes of slender build. Eggs and larvae as in the other genera of the sub-family. Two species occur here.

Remarks.—The Malayan species of this genus are readily distinguished from the members of the other genera of this sub-family by the absence of the caudal tuft and generally more slender build. The larva of T. Leicesteri is very peculiarly marked and the pupa is pure black and has the paddles like the tail of a fish.

Toxorhynchites Leicesteri.—*Theobald.*

Slender mosquito of moderate size with a handsome metallic-green scaled thorax, purple abdomen banded with blue. Legs banded in the female.

Female Head.—Black, covered with broad spatulate scales; along the orbital margin is a narrow band of scales broadening out laterally which are peacock-blue or in some lights rose-purple; the rest of the upper surface of the head is clothed with metallic-golden scales which may assume a golden-brown colour in the dry specimen. Immediately round the occipital

foramen are a few upright forked scales dark golden in colour, and on th vertex are some golden-brown bristles. Basal joint of antenna blacl frosted, nude, remaining joints black at the nodes, brown at the internodes verticillate hairs, black. Palpi four-jointed, very short, not more than one-sixt length of the proboscis, first joint swollen at the base and constricted, las joint small and nipple-like, clad with broad spatulate scales, under a hand len dark brown in stronger light, rich blue, except at the tip where the scale vary from rose-purple to mauve according to the angle at which the ligh strikes them. Proboscis, broad at the base long and bent, covered wit purple or rose-purple broad scales; at the angle the scales are golden-gree with some peacock-blue mixed among them.

Thorax.—Prothoracic lobes small, oval, rather prominent, thickly cla with scales which are purple-blue or rose-purple as the position to light i varied. Mesonotum black, densely covered with broadly spindle-shape metallic-green scales; over the bases of the wings the scales are larger longer and spatulate. In a fresh specimen the colouring is very muc like a green bottle fly. If the thorax is examined through a lens, th central part looks dark coppery-brown to purple, while the sides where th light strikes at an angle show metallic-green. In other light the scale appear bluish-green or dark coppery-red. At the anterior margin of th mesonotum is a band of scales which appear violet, or rose-purple accordin to the light and below this a triangular patch of silvery scales immediatel behind the prothoracic lobes, and over the roots of the wing a patch o peacock-blue scales and a row of short stout black bristles. Scutellum densely clad with large spatulate scales which on the lateral lobes are of peacock-blue or metallic-green according to the light and on the centra lobe a dark green fringed with lighter green posteriorly; scutellar bristles short and dark brown. Metanotum dark brown. Wings, brown in colour; costa and first longitudinal vein clad with broad spatulate scales which are peacock-blue, golden-green or purple according to the light. The median cross vein about its own length from the supernumerary, posterior cross vein curved and commencing just to the apical side of the median. Coxæ, yellowish, mid and hind clad with creamy scales on their outer face. Fore leg, upper surface of the femora clad with rose-purple scales, at the extreme apex is a tuft of long spindle-shaped scales which are white or peacock-blue, and just behind these is a ring of black spines; the whole of the under surface is covered with bright golden scales; tibia, entirely covered with purple scales; a short distance from the base on the metatarsus a ring of creamy-yellow scales, third and fourth tarsus mostly covered with creamy scales, the rest of the tarsus and metatarsus, purple scaled; mid leg, femora and tibia as in the fore legs, the basal half of metatarsus creamy scaled, apical half, purple scaled, all the tarsal joints creamy scaled; hind legs, femora golden at the base and on the under surface, purple above, scales at apex as in other legs, tibia, purple scaled, metatarsus, purple scaled, except for a broad ring of creamy scales a little beyond its base, first and second tarsal joints purple scaled, third and fourth, creamy scaled; ungues equal and simple on all the legs. Pleura dark brown for the most part covered with silvery-grey scales.

Abdomen.—Dorsum of first segment covered with peacock-blue scales, (in some lights a dark green), the other segments covered with rose-purple scales, with basal bands of peacock-blue. Venter, bright golden, except

or a patch of dark scales on the fourth segment. Last segment fringed with pale golden hairs.

Male Head.—A deep depression in the middle line. The scaling is much as in the female. Antennæ, banded brown and white, plumes black; basal joint black, second joint scaled with numerous broad golden scales, two last joints dark and elongated. Palpi three-jointed, first joint with swollen base having the appearance of a joint constricted in the middle, second very long, scaled with golden scales except at the apex where there is a narrow band of purple scales, and in the middle there is also a band of purple scales and towards the base there are on the upper surface purple scales. Proboscis purple scaled with green scales at the angle.

Thorax.—As in the female. Legs, coxæ and under sides of femora gold scaled, knee spots peacock-blue or creamy in some lights, the remaining parts of legs purple scaled: no banding. Ungues, fore and mid unequal, larger uniserrate. Abdomen as in female.

Occurrence.—Bred from larvæ found in bamboos.

Remarks.—This mosquito and the next change so much when dry that they are hardly recognizable from the description. The abdomen has become a dingy black in many cases owing to the colours being altered by the grease in the body. When fresh the colours are exceedingly brilliant the thorax being bright emerald-green, while the abdomen appears rich rose-purple with peacock-blue bands.

Toxorhynchites Metallicus.—*Theobald.*

This is a very handsome mosquito with a brilliant metallic-green thorax and bright rose-purple abdomen, banded with honey-yellow. In the male the legs are unbanded.

Female Head.—Black: there is a narrow band of creamy-yellow scales along the orbital margin which laterally broadens into a distinct patch; the rest of the upper surface of head is covered with broad spatulate scales which vary in colour, if looked at from behind the central patch looks bronze-green and the scales at the sides blue-green; in one specimen the whole patch is a deep rich blue, while the marginal scales are silvery. Immediately above the occipital foramen are a few fawn-coloured upright scales scarcely notched. A few small bristles are placed on the vertex which look black or purple or even golden-brown according to the light. Basal joint of antenna, black, with a silvery tomentum, naked, save for a few short white hairs, second joint scarcely swollen light yellow in colour with a few black spatulate scales on its upper face, succeeding joints, black with white down; verticillate hairs, black. Clypeus black with silvery tomentum notched on either side for the insertion of the palpi which are short, not more than one-sixth the length of the proboscis, and four-jointed; last joint small and nipple like, first two joints with golden scales at the sides and beneath, the two last joints are covered with scales which are coppery or rose-purple according to the angle the light strikes them. The proboscis is long and swollen at the base, and clad with purple or coppery scales.

Thorax.—Prothoracic lobes small, thickly covered with broad flat racquet-shaped scales of a creamy-yellow colour, and with a row of light brown bristles. Mesonotum, black, thickly clad with fusiform flat scales

which laterally become very broad and blunt ended, and which in a good light appear of a brilliant metallic-green to the naked eye in a fresh specimen while under a lens the colour varies from peacock-blue to bronze-purple and metallic-green the colour appearing intermixed, now one colour predominating, now another, as the fly is shifted to different positions. On the anterior margin are some golden scales and numerous golden bristles and laterally, in front, immediately behind the prothoracic lobes there is a band of metallic rose-purple scales and beneath this is a triangular patch of creamy-yellow scales: the two patches meet on a straight line but their external edges are convex hence with the prothoracic lobe they form a rough ellipse, composed of the three colours. The scutellum is clad with rather long spatulate scales which are coppery, bronzy or purple-bronze as the direction of the light varies. There is a tuft of bristles over the root of each wing. Scutellar bristles are brown in colour. Pleuræ are of a dark glistening chestnut-brown, naked in parts, scaled in other parts with creamy-yellow, or honey-yellow scales. The wings are quite typical. The costa and first longitudinal are scaled with metallic rose-purple scales. Coxæ and femora light yellow, tibia and tarsi much darker. The coxæ, bases and under surface of femora clad with metallic-golden scales, the upper and lateral surfaces of femora and the whole tibia and tarsus of fore leg covered with brilliant metallic scales varying from coppery-bronze to rose-purple or bronze-purple, creamy scales at the apices of all the femora; mid leg as the fore except for a band of golden scales at the base of the metatarsus and golden scales covering the penultimate tarsal joint; tibia and tarsus of hind leg same as fore. Ungues equal and simple. Metanotum black.

Abdomen.—First segment scaled honey-yellow laterally, rose-purple centrally, the other segments brilliant rose-purple with creamy-yellow or honey-yellow banding, expanding laterally into triangular patches; venter scaled with metallic-golden scales except segment four which has a patch of dark purple scales.

Male Head.—Black with a deep furrow in the centre. There is a large central patch of flat scales of a bronze-green or golden-green colour while the scales along the orbital margin are peacock-blue, and laterally there is a patch of scales peacock-blue or rose-purple according to the light in which they are seen. Basal joint of antenna black and nude; remaining joints, creamy, growing darker towards the apex, second joint scaled with spatulate and elongated scales of a dark brown colour, few shewing metallic colouring. There are numerous dark brown hairs on the joint; verticillate hairs, dark brown, almost black, neither very dense nor very long. The antennæ are not nearly so marked a feature as they are in a Teromyia. Palpi, three-jointed, the first joint shews a slight swelling at the base and there is a thinning of the chitin which looks like a joint, but is not, there is also a second thinning more basally and the chitin is folded in: the whole joint is very long, the second joint is about half the length of first, the third is long and pointed almost as long as first; first joint is almost entirely golden scaled, except on its upper surface near its base where there is a patch of rose-purple scales and a band of the same about its middle and a few dark scales at the apex dorsally, second joint is golden scaled beneath and laterally except apically, and purple scaled above; the third joint is entirely purple scaled. Proboscis scaled with purple scales to the angle

nen green scaled. The markings of both proboscis and palpi vary. In ne specimen I have the first joint of palpus is entirely gold-scaled save for ring of purple scales on the middle and apex. The thorax is similar to he female. Coxæ and undersides of femora are golden scaled, the upper urfaces of the femora and the rest of all the legs are clad with purple scales. A few pale scales are inserted at the apices of the femora. Fore and mid ngues unequal larger tooth uniserrate.

Abdomen.—Scaled as in the female. No caudal tuft. A few rather long golden hairs inserted on the two last segments.

Occurrence.—Bred from larvae found in water collected in bamboos.

Remarks.—Like *T. Leicesteri* this mosquito suffers great loss of brilliancy nd change of colour when dry and old. It is quite distinct from it as the bdominal banding is rich yellow not blue, and the patches of scales behind he prothoracic lobes are quite different in the two species. I have never aken the adult of this mosquito. It is entirely sylvan and fairly widely distributed in the Peninsula.

Sub-Family **CULICINÆ.**—*Theobald.*

Characters.—Palpi in the male usually longer than the proboscis but in a few genera they are shorter but never so short as in the subsequent sub-families. Palpi in the female usually about one-quarter the length of the proboscis and according to Theobald three to five-jointed. Head clad either entirely with spatulate and upright forked scales or with narrow-curved scales in the centre and spatulate scales laterally with upright forked inserted amongst these over the larger part of the surface of the head. Thorax generally clad with narrow-curved scales only, but in some cases with spatulate scales on the margins as well. Scutellum variously scaled. Median cross-vein of wing in all genera except Mucidus and Ekrinomyia always nearer the apex of the wing than the posterior cross-vein. Fork cells long.

Remarks.—This is the largest of all the sub-families and indeed gives its name to the Family Culicidæ. It contains genera with very varied characteristics. I have in my synoptic table given all the known genera as published in the "Genera Insectorum" 26 me, fascicule 1905, which is, I believe, the latest out. Many of these genera are unrepresented in Malaya. In the synoptic table adopted the arrangement differs from that of Mr. Theobald and in some cases under "remarks" on genera the reasons for placing such and such a genus in the position it is placed are given. I have endeavoured to make the key as simple and natural as possible. The genus Orthopodomyia is placed at the end as in my opinion it is somewhat doubtful whether it should not come in the following sub-family Aedeomyinæ, for in many respects it is closely allied to Aedeomyia and the palpi in male and female are scarcely those of a culicine. Since constructing the key I have seen Mr. Theobald and received his recent changes in the classification in which he has transferred some genera from Aedeomyina to Culicina and I have made changes in my table in accordance with his with the desire of bringing my synoptic table up to date. It is an extremely difficult matter to alter such a table without reconstructing the whole, and if there are errors the excuse must be the awkwardness of having to effect changes at the last moment.

Synoptic Table of Genera.

Section I.—Legs densely scaled or with patches of long erect scales.

(*a.*) Head with broad fusiform scales. Thorax and scutellum with fusiform scales. Female ungues thick. Position of cross veins normal*. Hind legs densely scaled.....*Genus* 1.—Janthinosoma.

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* Note.—The term normal used in connection with cross-veins of wing means such a condition as is found in the cross-veins of a culex which in the vast number of mosquitoes is the usual position. The mid cross vein is in line with the median and the commencement of the posterior cross-veins is always on the side of the median nearer the base of the wing.

(*b.*) Head with broad curved scales. Thorax with narrow-curved scales and short broad ones laterally. Female palpi about half the length of the proboscis. Legs with patches of erect scales. Cross veins normal.* ..... *Genus* 2.—PSOROPHORA.

(*c.*) Head with broad flat scales; thorax with narrow curved scales; Scutellum with broad scales on the central lobe. Last two tarsi of the hind legs in the male with long erect scales. Cross veins normal.* ..... *Genus* 3.—ERETMAPODITES.

(*d.*) Head with narrow-curved long twisted and spatulate scales; thorax and scutellum with long twisted scales. Posterior cross vein nearer the apex of the wing than the mid. Female palpi half as long as the proboscis. All legs with erect scales..... *Genus* 4.—MUCIDUS.

:CTION II.—Legs with scales lying flat. Posterior cross vein nearer the apex of the wing than the mid. Wings with spots of pigment.

(*a.*) Head with narrow curved scales above spatulate ones at the sides. Abdomen much curved. Thorax and scutellum with narrow curved scales..... *Genus* 5.—EKRINOMYIA.

:CTION III.—Legs with scales lying flat. Cross veins normal.* Mesonotum with narrow curved scales.

(*a.*) Head and scutellum with broad spatulate scales except in Desvoidya where there are a few narrow curved scales on the nape.

(1.) Female palpi less than half the length of the proboscis. Legs and abdomen unbanded. Large mosquitoes. Head with a few narrow curved scales on the nape..... *Genus* 6.—DESVOIDYA.

(2.) Head with flat and upright scales only. Female palpi less than half the length of the proboscis. Legs and abdomen generally banded. Small mosquitoes..... *Genus* 7.—STEGOMYIA.

(3.) Female palpi more than half the length of the proboscis. Metanotum nude..... *Genus* 8.—LEICESTERIA.

(4.) Female palpi more than half the length of the proboscis. Metanotum with chaetae..... *Genus* 9.—CHAETOMYIA.

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* NOTE.—The term normal used in connection with cross-veins of wing means such a condition as is nd in the cross-veins of a culex which in the vast number of mosquitoes is the usual position. The mid ss vein is in line with the median and the commencement of the posterior cross-vein is always on the e of the median nearer the base of the wing.

(5.) Female palpi less than half the length of the proboscis. Male palpi considerably shorter than the proboscis. Bristles on the mesonotum unusually long..... *Genus* 10.—DASYMYIA

(*b.*) Head with a few narrow-curved scales either on the vertex or the nape or forming a central line, and broad spatulate scales over the rest of its surface. Scutellum with spatulate or with narrow-curved and spatulate scales.

(1.) Head with smoothly-laid flat scales except on the nape when there are a few narrow-curved. Mid lobe of scutellum with small flat scales lateral lobes with narrow-curved ones..... *Genus* 11.—PHAGOMYIA.

(2.) Head with spatulate scales and a few narrow-curved on the nape. Scutellum with spatulate scales on the mid lobe and narrow-curved ones on the lateral lobes..... *Genus* 12.—CATAGEIOMYIA.

(3.) Head with flat scales except on the nape where there are some narrow-curved ones. Scutellum with fusiform scales on the mid lobe and flat ones on the lateral lobes..... *Genus* 13.—POLYLEPTIOMYIA.

(4.) Head with spatulate scales and a few narrow-curved ones on the vertex. Scutellum with spatulate scales only..... *Genus* 14.—SCUTOMYIA.

(5.) Head with scattered narrow-curved scales on the nape a central line of similar scales and spatulate scales over the rest of its surface. Scutellum with the central lobe clad with fusiform scales in the middle line and small scales on either side of this and lanceolate scales on the lateral lobes..... *Genus* 15.—HULECOETEOMYIA.

(6.) Head with a median line of narrow curved scales and spatulate scales over the rest of its surface. Scutellum with spatulate scales on the median lobe and narrow-curved ones on the lateral lobes.... *Genus* 16.—MACLEAYA.

(*c.*) Head with spatulate scales only or with spatulate scales and a few narrow-curved ones confined to the middle line. Scutellum with narrow-curved scales only.

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* NOTE.—The term normal used in connection with cross-veins of wing means such a condition as i found in the cross-veins of a culex which in the vast number of mosquitoes is the usual position. The mi cross vein is in line with the median and the commencement of the posterior cross-vein is always on th side of the median nearer the base of the wing.

(1.) Head with a narrow median line of narrow-curved scales and spatulate scales over the rest of the surface. Scutellum with narrow curved scales only.....*Genus* 17.—HOWARDINA.

(2.) Head with a few narrow-curved scales behind and in front in the middle line and loosely applied spatulate scales elsewhere. Male palpi clavate. Wing-scales culex-like.....*Genus* 18.—ACARTOMYIA.

(3.) Head with spatulate scales only. Male palpi clavate. Wings with broad spatulate median and no lateral scales.....*Genus* 19.—CONOPOMYIA.

(4.) Head entirely clad with spatulate scales. Scutellum with narrow-curved scales. Male palpi short. Wings with densely clad fork cells.....*Genus* 20.—SKUSEA.

(5.) Head with elongated spatulate scales and a few narrow-curved ones behind on the nape. Male palpi slender.....*Genus* 21.—DANIELSIA.

(6.) Head with spatulate scales coming right up to the middle line in front enclosing a central triangular area broadest behind which is clad with narrow-curved scales. The lateral scales on the apices of the wing veins are markedly clavate. Male antennae with peculiar tufts of long scales.....*Genus* 22.—LOPHOCERATOMYIA.

(*d.*) Head with a broad area above clad with scattered narrow-curved scales the lateral areas clad with spatulate scales. Upright scales numerous and inserted as far forwards as the vertex.

(1.) Scutellum entirely clad with long spatulate scales with serrated ends.

(A.) Wings like culex.....*Genus* 23.—LEPIDOTOMYIA.

(2.) Scutellum with spatulate scales on the lateral lobes and at the base of the median lobe, narrow-curved at its apex.

(A.) Last two joints of male palpi equal and shorter than those in culex.....*Genus* 24.—GEITONOMYIA.

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* NOTE.—The term normal used in connection with cross-veins of wing means such a condition as is found in the cross-veins of a culex which in the vast number of mosquitoes is the usual position. The mid cross vein is in line with the median and the commencement of the posterior cross-vein is always on the side of the median nearer the base of the wing.

(3.) Scutellum with narrow-curved scales only.

(A.) Male palpi clavate. Wings with large lanceolate scales collected into masses forming spots.....*Genus* 25.—THEOBALDIA.

(B.) Male palpi acuminate. Female palpi four-jointed. Wings with patches of large Taeniorhyncus-like scales.....*Genus* 26.—LUTZIA.

(C.) Characters the same as Culex except the wings which have the apices of the veins clad well-marked clavate scales.....*Genus* 27.—MELANOCONION.

(D.) Male palpi with two last joints subulate and hairy. Wings with narrow scales and generally unspotted.....*Genus* 28.—CULEX.

(E.) Head with rather broad fusiform scales. Wings with broad Taeniorhyncus-like scales..*Genus* 29.—GILESIA.

(F.) Wings with rather broad scales neither so long nor so dense as in Taeniorhyncus. Head scaled like that of culex.....*Genus* 30.—GRABHAMIA.

(G.) Head and wings as in culex. Abdomen with tufts of erect scales with dentate free ends .....*Genus* 31.—LASIOCONOPS.

(*e.*) Head with narrow-curved scales above, spatulate scales at the sides, and upright scales all over. Wings with very large scales some of which are asymmetrical.

(A.) Male palpi long the last two joints being as in culex. Wing scales either fusiform or broad and asymmetrical.....*Genus* 32.—TAENIORHYNCUS.

(B.) Male palpi with a minute ultimate joint. Wing scales very broad broader than those in any other genus and asymmetrical. Legs much banded and spotted.....*Genus* 33.—MANSONIA.

(C.) Female palpi half as long as the proboscis male palpi not as long as the proboscis. Wing scales broad and piriform.....*Genus* 34.—ORTHOPODOMYIA.

(*f.*) Head with flat scales, broad curved scales and numerous upright forked ones. Scutellum with flat scales. Wing with broad piriform scales.....*Genus* 35.—FINLAYA.

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* NOTE.—The term normal used in connection with cross-veins of wing means such a condition as is found in the cross-veins of a culex which in the vast number of mosquitoes is the usual position. The mid cross vein is in line with the median and the commencement of the posterior cross-vein is always on the side of the median nearer the base of the wing.

The first three genera of this sub-family, viz., Janthinosoma, Psorophora and Eretmapodites are apparently unrepresented here.

Genus 4.—**Mucidus.**—*Theobald.*

Head with a central line of long twisted scales, on either side of these are scattered narrow-curved scales and still more laterally patches of spatulate scales; numerous upright scales of great length are inserted above and laterally. Mesonotum clad with narrow hair-like scales in the centre, and patches of long twisted scales at the sides. Scutellum with narrow-curved and long twisted scales. Legs clothed with long erect scales which give the insect a very ragged mouldy appearance. Wings with large clavate and piriform scales; posterior cross vein nearer the apex of the wing than the mid.

Remarks.—Only one species of this genus appears to occur here and it agrees in all respects with the description of M. Mucidus in Theobald's Monograph. The larvae are carnivorous and resemble the larvae of a Megarhine.

Mucidus Mucidus.—*Theobald.*

Head light greyish-brown with a broad central line of snowy-white long curved and twisted scales and white narrow curved scales on either side of this succeeded by white spatulate and then dark brown spatulate scales. Thorax with a median line of yellowish-brown flanked by dark grey lines and outside these the colour is light yellowish-brown. Numerous long hair-like scales cover the dorsum and there are patches of long snowy-white twisted scales. Legs yellowish with a dense clothing of white, dark brown and parti-coloured scales, all these scales standing out from their insertion. Wings with dark brown and yellow scales with white spots in the fringe.

Female Head.—Light fawn-brown with a greyish tomentum; in the centre is a broad line of irregular twisted and narrow-curved scales mixed, and on either side of this are scattered yellow narrow-curved scales and outside these is first a patch of white spatulate scales and then a patch of dark brown; the upright scales are exceedingly long and slender, and are dark brown in colour; on the vertex is a tuft of golden-brown bristles and similar bristles are inserted along the orbital margins. Basal joint of antenna light brownish-yellow with a patch of white scales on its inner face, second joint yellow with a dark shading in the middle and a line of dark scales on its inner side, remaining joints light yellow with pale brown verticils. Palpi more than half the length of the proboscis of a yellowish colour clad with a mixture of dark brown and white scales all of which stand out from the surface and give the palpi a very ragged appearance. Proboscis yellowish with scales similar to those on the palpi.

Thorax.—Prothoracic lobes dark fawn clad above with pure white fusiform and elliptical scales below with long twisted scales. Mesonotum yellowish-brown with two rather broad dark grey lines one on either side of the middle line which start from the anterior margin and when about two-thirds of the way down the mesonotum they merge into large patches of dark

grey which are placed one over each wing base; this is well seen with a hand lens. The greater part of the mesonotum is clad with long thin hair-like curved scales mostly white but with pale yellow ones amongst them and in addition to these scales there are about six well-defined patches of long white twisted scales; down the centre is a row of golden-brown bristles and there are others scattered over the surface. Scutellum yellowish with short and long snow-white irregular scales. Pleurae with light yellow and deep brown patches and with patches of elliptical and long irregular scales. Wings yellowish in front and clad with yellowish and parti-coloured scales which are yellowish at the base black at the tips; towards the apices of the veins the scales are clavate but not so markedly as those at the base of the wing. The fork cells are of medium length the first longer and narrower than the second, its base nearer the apex of the wing, its stem rather longer than the cell. In the region of the cross veins the wing is stained with dark brown pigment. The supernumerary and mid cross-veins lie in one line and the posterior cross vein is a trifle to the apical side of the median. The fringe at the apex is deep golden as far as the upper branch of the second vein then black as far as the third vein then pale yellow followed by black and then pale spots. Coxae ochraceous with erect black and white scales; femora brownish-yellow clad entirely with erect parti-coloured scales and white ones mixed and in places the white are massed into bands as follows: a narrow one about the middle of each femur and a fairly broad one at the apex of each, on each tibia there is a white band at base, apex and in the middle the one at the apex being very broad and conspicuous. The fore and mid metatarsi and tarsi are golden-brown with parti-coloured scales black at the tip. On the hind leg there is a narrow white band at the base of the metatarsus and the tarsal joints are nearly all white scaled. The ungues on all the legs (even the hind) are large and stout and each unguis bears a very large tooth.

Abdomen.—First segment fawn-brown naked except for a central tuft of large broad scales some of which are cordate others fan-shaped with finely dentate free ends. Most of these scales are white but a few are yellowish-brown. There are numerous fine long hairs of a golden-brown colour also present on this segment. The second segment has a central tuft of fan-shaped scales with dentate ends white and golden-brown in colour and on either side is a tuft similar scales pure white in colour while the intermediate surface is clad with blackish scales, the third segment has a central mass of ochraceous scales and towards its apex numerous large erect fan-shaped scales ochraceous at the bases dull black at their tips, the remaining segments are clad with a mixture of ochraceous, parti-coloured and pure white scales, the white predominating on the terminal segments and forming broad white bands.

Male.—Basal joint of antenna rich apricot, remaining segments banded dark-brown and golden-brown; plumes bright golden-brown. Palpi longer than the proboscis by their ultimate joint; all the joints are of a golden-brown colour; the ultimate joint has a few long white scales at the base and scattered parti-coloured scales over the rest of its surface and lateral rows of long golden hairs, the penultimate joint is white scaled at its base and apex the scales at the base lying flat and between these scales are golden and

parti-coloured scales, with long golden hairs are inserted on either side, antepenultimate joint clad with white, golden and parti-coloured scales irregularly mixed. The ungues on the fore leg are markedly unequal the larger unguis being enormous and having two teeth while the small unguis is simple; on the mid leg the larger unguis is bi-serrate but the smaller unguis also bears a tooth. The ungues of the hind leg are simple and very small. In all other respects the male resembles the female.

Occurrence.—Described from one male and female bred from larvae taken in marshy ground near a patch of jungle near Kuala Lumpur.

Remarks.—Evidently a very rare species here as no specimen has before been described from the Malay Peninsula and even in Africa it does not seem common as no male has been obtained or at least there is no description of the male. I only obtained two larvae and was very fortunate to obtain a specimen of each sex. The only point THEOBALD has neglected to mention is the curious fact that the hind ungues in the female are as large as those on the fore and mid legs and they also bear a tooth. This is a most unusual condition in a mosquito and is worthy of special notice. In all other respects my description agrees with THEOBALD except the presence of the dark grey lines and patches on the mesonotum.

Genus 5.—**Ekrinomyia.**—NOV. GEN.

Head with narrow-curved scales above, spatulate scales at the sides and upright scales over the whole upper and lateral surfaces. Female palpi fully one-third the length of the proboscis, male palpi about as long as the proboscis, the last two joints not very hairy. Wings with spots of pigment; posterior cross vein nearer the apex of the wing than the mid. Thorax and scutellum with narrow-curved scales. Abdomen bent in a half-circle. Legs very long. Larva carnivorous.

Remarks.—This mosquito presents so many points of difference from culex and allied genera and so many points of resemblance to Mucidus that I have placed it in a separate genus next to the last-named. The position of the posterior cross-vein is so very rare in Culicidae being present only in Megarhinina and Mucidus that I regard it quite of generic importance. The larva comes very near that of the Megarhines which is another important character. I have only one species at present.

EKRINOMYIA AUREOSTRIATA. N. SP.

Head covered with brilliant golden-yellow scales. Proboscis and palpi yellow-scaled with a few black scales interspersed. Thorax dark purple-brown with a few golden scales in front and behind. Abdomen purple-brown spotted with yellow especially towards the apex. Tibiae and thighs mottled brown and yellow. Tarsi basally banded last hind tarsal joint canary-yellow. Wings lightly scaled with brown and yellow scales markedly pigmented at the cross veins.

Female Head.—Dark brown, clad above thickly with rather long narrow-curved golden-yellow scales and at the sides with long strap-shaped golden scales. Numerous long narrow golden-brown upright forked scales are inserted on the upper surface extending from the nape forward to the vertex

and laterally to the margin of the flat lateral scales. The colour of the scale along the orbital margins is metallic-gold but the rest of the scales a darker approaching rather the colour known as old gold. Running dow the centre is a bare line the scales on either side looking outward Vertical and orbital bristles golden-yellow. Basal joint of antenna golde brown with a few golden-yellow scales on its inner face, second joint ding yellow, remaining joints dusky-brown, pale at the insertion of the verticil covered with silky white pubescence; verticillate hairs brown. Clypeu golden-brown. Palpi about one-third the length of the proboscis, fou possibly five-jointed; second apparent joint is large about one-fifth tot length of palpus, last joint is small and round like a ball. The scales ar dark yellow with some black scales at the base above. The last joint an the apical third of the penultimate joint are entirely black scaled. Th black scaled portion of what I call penultimate joint is I believe a separat joint but with the scales it is impossible to assert this positively. Probosci long and densely scaled with dark yellow scales with numerous black scale scattered irregularly over it; the extreme apex at the base of the labellae i black scaled.

Thorax.—Prothoracic lobes large, prominent, dark brown with a hoary tomentum, clad externally with numerous long narrow-curved golden yellow scales, and above and anteriorly with numerous dark blackish-brown bristles. Mesonotum very dark brown, in front and on the shoulders there are small patches of golden-yellow narrow curved scales, the rest is clad with dark purple scales which in some lights appear dark grey or even take a brown tinge from the mesonotum. The alar bristles are long and numerous and of a similar colour to the scales. In the centre are one or two dingy yellow bristles. Scutellum dark brown clad with numerous narrow-curved golden-yellow scales. Bristles golden arranged in two rows apparently six short anterior bristles and nine posterior longer and arranged in sets of three. Pleura dark blackish-brown with a few scales, patches and rows of blackish-brown bristles. The mesothoracic stigma stands out in a very unusual way and seems exceptionally large. Wings longer than abdomen of a golden colour and with distinct patches of dark brown pigment as follows: between the subcostal and first long vein at a point opposite the junction of basal and middle thirds of the wing, another spot where the second long vein comes off from the first, and large patches in the region of the cross veins. Scales on the costa small dark brown with a few golden ones. First long vein ends almost at the apex of wing and is clad with three rows of small dark brown ligulate median scales in its whole length and on the terminal fifth with a few linear lateral scales, stem of second vein clad with double row of ligulate pale yellow median scales, its branches with long ligulate dark brown lateral scales, third vein with dark brown and a few yellow very small median scales and long ligulate lateral scales at its apex, rest of the veins with median scales only, except apex of upper branch of fourth; first fork cell longer and narrower than second about as long as its stem its base nearer wing apex than the base of the second, supernumerary cross vein as long as the median which lies slightly nearer the base of the wing; posterior cross vein less than half its own length distant from the median and lying nearer the apex of the wing, fringe scales short. Coxae dark blackish-brown; front coxae flattened from side to side and with a deep notch in

ne upper half anteriorly, a patch of yellow and brown ligulate scales nserted below this notch; mid coxae with a small patch of yellow scales n the outer face; femora of all the legs with a ring of dark yellow scales t the base and more or less complete ring at the apex, between mottled nd banded with dark yellow and dark brown scales; tibiae the same as he femora; the metatarsi of fore and mid legs are basally banded and clad ith dark brown scales with a few scattered golden ones more numerous on he ventral surface; tarsi scaled dark brown with broad creamy-yellow basal ands; hind metatarsi clad with dark purple-brown scales and with creamy-ellow band at their base, tarsi basally banded, last tarsal joint canary-ellow. A row of golden spines is inserted along the whole length of ach face of all the femora and tibiae. Fore and mid ungues equal and niserrate, hind equal and simple.

Abdomen.—Relatively slight. The living fly carries its abdomen flexed n a quarter circle. The labellae are very large and prominent, and scaling ense, the scales being dark purple-brown ; on the dorsum at the base of the hird segment are a few dark yellow scales, on the fourth segment there are wo distinct patches about the middle of the segment, on the fifth there are umerous golden-brown scales on the apical half and on the remaining egments the golden-brown scales predominate giving the apex of the bdomen a yellowish-brown colour. On the venter the basal half of all the egments is scaled golden-brown. In another specimen the first segment has narrow basal band of golden scales and two small patches as in the male. The band consists of two semi-circular patches and the small patches are ttached like pendants. The second segment is similarly marked and after hat gold scales predominate.

Male Head.—Colour and scaling as in the female. Basal joint of ntenna golden-brown with a patch of ligulate golden-yellow scales on the nner face, remaining joints dusky with a dark ring at the insertion of the erticils. Plumes golden-brown near their insertions darkening to a light urple-brown towards the tips. Palpi longer than the proboscis by about he last joint, four-jointed, basal joint golden-brown, nude, constricted in its entre, about half as long as the terminal joint, second joint about as long as he other three joints together, with a narrow ring of black scales at its base hen a broad band of golden-yellow scales then a narrow band of black cales followed by a band of golden-yellow and then a broad band of black cales, third joint golden scaled except for a few black scales on the upper urface at the apex and covered with numerous silky pale brown hairs, ltimate joint with golden scales at the base and black scales on the apical wo-thirds. Proboscis except for a few black scales at the base entirely overed with golden-yellow scales; about the junction of the middle and pical thirds the proboscis shews a distinct joint.

Thorax.—Similar to the female. Wings: fork cells smaller than in the emale, stem of first fork cell nearly twice as long as the cell, the cell much narrower and about as long as the second its base much nearer the apex of he wing ; posterior cross vein nearer mid cross vein than in the female but still on the apical side. There are fewer lateral scales there being none on he second posterior cell. Legs; the golden scales are more numerous on he femora; the fore and mid ungues are unequal, the larger unguis is uni-serrate the small simple.

Abdomen.—First segment with patches of black scales and numerou black brown bristles, second segment has a narrow band of golden scales the base and two small patches of golden scales in front of this the re being scaled with black-brown scales, the remaining segments are almo entirely golden scaled.

Occurrence.—Described from three females and four males which wer taken as pupae in a small hole in marshy ground at Klang.

Remarks.—A large mosquito with wings longer than abdomen and whe alive the abdomen is bent upon itself in a characteristic way, very lik Mucidus. From one larva taken in the same hole but not examine carefully as it died in transit I suspect it is carnivorous. It resembled megarhine larva in shape and colouration and as far as could be seen wit a lens in the structure of the mouth parts.

Genus 6.—**Desvoidya.**—*Blanchard.*

ARMIGERES.—*Theobald.*

Head clothed with large square-ended spatulate scales, a small patch c narrow-curved scales on the nape and a few rows of upright scales confine to the nape. Palpi in the female, never more than one-fourth the length of th proboscis, in the male a little longer than the proboscis very slender and with out hairs. The clypeus may or may not be scaled. Prothoracic lobes wit narrow-curved and spatulate scales. Mesonotum with long rather broa curved scales and a marginal line of broad curved scales. Scutellum witl large spatulate scales. Wings with rather broad linear lateral scales. Mal claspers curved with a row of blunt teeth.

Remarks.—In the main essentials the above are the characters given fo this genus in THEOBALD'S "Monograph" except the narrow-curved scales o the head. As these are very few in number and are inserted far back o the occiput it is easy to miss them indeed if the head is pressed u against the thorax as it often is they cannot be seen. This genus is closely allied to Leicesteria but differs in the following characters: the female palp are never as long as in the latter genus the abdomen is much stouter the prothoracic lobes have narrow-curved as well as spatulate scales and the marginal line on the mesonotum is composed of broad curved scales and not spatulate scales as in Leicesteria. In the male Desvoidya the claspers are armed with a row of blunt teeth while in Leicesteria the clasper bears three or four long finger-like processes on its apex. Three well marked species occur here one of which D. Aureolineata is certainly new while D. Jugraensis is doubtfully so for it may be the D. Fusca described by THEOBALD. My types of D. Obturbans differ in some minor points from the description given in THEOBALD but I consider that they are that species.* One curious feature in this genus is the occasional presence of scales on the clypeus. It is only seen in certain species and in the adults of even these species they

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N.B.—In comparing any particular specimen with this description it would be well to read the remarks at the end of the description as to the variations in different specimens.

* Since writing I have compared my specimens with the British Museum types and found them identical.

not always present. They are fairly common mosquitoes in the jungle d often appear in houses if there is any jungle in the neighbourhood. ıey are vicious biters. They lay their eggs as single black thick-shelled gs very like those of Stegomyia. The larvae are large and stout th very short respiratory syphons and greatly enlarged anal papillae. ıeir position is vertical to the surface of the water and they are mainly ttom feeders. Generally speaking their breeding habits are similar to ɔse of Stegomyia.

DESVOIDYA OTURBANS.—*Walker.*

Head entirely clad with black scales except for a narrow silvery margin the eyes and a few pale scales on the nape. Thorax with well marked ırginal band of scales creamy or pale ochraceous and bronze scales on the rsum. Scutellum with large spatulate blue-black scales sometimes with me pale ochraceous ones on the central lobe. Legs with white knee ots. Abdomen with large triangular lateral patches.

Female Head.—Black, on the space between the eyes are a few silvery rrow-curved scales and there is a small patch of similar scales in the ntre on the nape; along the orbital margin of either side is a row of small very spatulate scales and low down on either side is a patch of similar ales; all the rest of the head is clad with large blue-black spatulate scales, cept that on the nape in front of the patch of narrow-curved scales are ree or four ochraceous spatulate scales. Unless the head is well separated ɔm the thorax the patch of white narrow-curved scales cannot be seen, but I ıve a large series of these mosquitoes and some of them shew this patch ry plainly. Vertical and orbital bristles brown. Basal joint of antenna ruginous with darker shading on the inner side, the inner and lower face clad with small silvery spatulate scales, second joint pale at its base deep own at its apex with a few dark brown scales, remaining joints deep own with dark brown verticils. Palpi almost one-third the length of the oboscis clad with blackish-brown scales. Clypeus purple-brown with very spatulate scales. Proboscis thick especially the apical third, clad ith blackish-brown scales.

Thorax.—Prothoracic lobes deep purple, in front and below clad with a ixture of silvery scales some being spatulate others broad crescentic, ɔove and behind it is clad with dark bronze scales also of two shapes. he line separating the two colours is oblique passing from above down- ards and backwards. This differential scaling of the prothoracic lobes by no means uncommon in members of the Culicidae though it does not em to have attracted any attention. A row of long dark brown bristles ıns down each lobe. Mesonotum chestnut-brown with a purple tinge ensely clothed with long hair-like bronzy scales; on the anterior margin ver the nape and shoulders are patches of ochraceous rather broad cres- ntic scales, and on either shoulder is a large patch of similar scales while ong the lateral margin running backwards over the wing roots is a band broad crescentic scales ochraceous or sometimes white in colour. In a ell-preserved specimen this marginal band is very conspicuous but never ɔ broad as in D. Jugraensis. In most specimens in the centre of the

mesonotum at the base of the scutellum there is a patch of large spatula ochraceous scales always present in the male. Scutellum brown clad wi large spatulate scales blue-black or purple-bronze in colour and sometim there are a few pale ochraceous scales on the central lobe. Pleurae da brown with patches of silvery spatulate scales. Wings dark brown wi dark brown scales; the lateral scales are long with parallel sides a rounded ends a shape I have called somewhat paradoxically broadly linea Fork cells rather long, the first a little longer and narrower than t second, its base nearer the apex of the wing, its stem two-thirds the length the cell; posterior cross vein longer than the median, distant from it less tha its own length; third long vein carried past the cross veins as an unscale vein to the base of the wing. Coxae light brown with silvery scales; fo and mid femora with dark purple-black scales above and laterally a silvery scales beneath; hind femora silvery beneath and at the sides; apic of femora with a few white scales; tibiae, metatarsi and tarsi of a legs clad with purple-black scales; ungues on fore and mid legs un serrate.

Abdomen.—Clad above with black scales and on the venter with silve scales; at the base of each segment after the first is a large white patc triangular in shape with the apex backwards one side of the triang corresponding with line of division between the segments.

Male.—The white scaling on the head covers a greater area than th in the female head; along the orbital margin there is the same row of ve small silvery scales running transversely to the other scales, but i addition the first row of large scales is white. In the centre on either side the middle line are white spatulate scales and on the nape in addition to th few narrow curved white scales there are some long linear or clavate silve scales. The upright scales are few in number black in colour and confine to the nape. Antennae plumose light yellowish-brown in colour and th plumes are black or deep brown. Palpi very slender about as long as th proboscis and clad with black scales.

Remarks.—This mosquito varies somewhat in the colour of the mes notum, in some specimens it is dark chestnut-brown in others it is lighte In all my types the lateral lobes of the scutellum are clad with purpl black scales but the middle lobe has a few white scales in the female an in the male it is almost entirely scaled with creamy-yellow scales whic form one with a patch of similar scales on the mesonotum at the base the central scutellar lobe. In the types described in THEOBALD both thes varieties are mentioned those from Naina Tal in India have the latera lobes white scaled. It is a fairly common mosquito here in the jungle an in houses with jungle in close proximity. No mention is made of the patc of pale scales seen on the nape. In all other respects my types agree wit the description in THEOBALD. In one male the lateral lobes of scutellu are clad with white scales at the apex and purple-black at the base. Th central lobe is white scaled and the bare space on the mesonotum in fron of central lobe of scutellum is clad on either side with long narrow slightl curved creamy scales and a few broad spatulate scales of a pale yellow a the immediate base. The amount of pale scaling in the centre of the hea varies considerably, in one male it occupies a triangular area over the nap and a broad central line running forwards to the vertex.

Desvoidya Jugraensis. n. sp.

A very black mosquito of medium size. Head black with narrow very orbital margin. Thorax black with white shoulders and broad very margins in the male. Abdomen black above with triangular silvery ots and a white band at the base of the fifth and sixth segments. Legs tirely black.

Female Head.—Entirely scaled with black spatulate scales except for a ngle row of silvery scales along the orbital margins and a few black narrow- rved scales on the nape seen with great difficulty and not at all unless e head is well flexed on the neck exposing the posterior portion. ertical bristles pale brown, orbital black. Basal joint of antenna black ith silvery piriform scales, remaining joints black with black verticillate tirs. Palpi about three-quarters the length of the proboscis and black aled. Proboscis not as long as the abdomen clad with black scales. lypeus black and nude.

Thorax.—Prothoracic lobes black, clad on the anterior face with lvery spatulate scales, behind above with blackish narrow-curved scales nd below with silvery broad curved scales. Mesonotum black clad with umerous black narrow lanceolate scales but little curved; shoulders ad with silvery fusiform scales, a few narrow silvery scales in ont of each wing which do not extend as far forwards as the shoulder. he scales on the mesonotum towards the base of the scutellum are roader than the scales in front and at the junction of mesonotum and cutellum the scales are long spatulate scales. Scutellum dark reddish- rown at the base, black at the apex, clad with large spatulate black scales nd brown bristles six or seven to middle lobe. Pleura black with patches of ilvery spatulate scales. Wings clad with black scales rather broader than s usual in members of this genus; the median scales are linear and set in wo rows, the lateral are long linear scales towards the bases of the veins ut on the branches of the second vein the scales are much broader and horter; first fork cell longer than second, its base nearer the apex of the wing s stem about two-thirds the length of the cell; posterior cross vein about s long as the median from which it is distant less than its own length. Coxæ lackish-brown with silvery scales, legs entirely black scaled except the nder sides of hind femora which are silvery and very spiny; fore and mid ngues equal and uni-serrate.

Abdomen.—Dorsally clad with black with a small silvery patch on the ighth segment; ventrally the segments are black scaled except the first which is entirely white scaled and the fifth and sixth each of which has a ilvery basal band. In some specimens the venter is entirely clad with ilvery scales. The lateral spots are triangular and present on the first even segments.

Male.—The silvery margin along the eyes is broader than in the emale, the antennæ are plumose with a black basal joint and the other oints white; the palpi are longer than the proboscis and the last two joints are about equal. On either margin of the mesonotum there is a very broad band of silvery scales ending at the bases of the wings. A narrow silvery

line extends from the base of the scutellum on to the scutellum. T whole of the venter is silvery scaled; fore ungues markedly unequal a each unguis uni-serrate; mid ungues nearly equal and uni-serrate.

Occurrence.—The larvæ found in a bamboo in Ampang jungle and wat collected in a fallen leaf in the jungle at Jugra, also on the East Coa and elsewhere. I have received specimens from Borneo.

Remarks.—This mosquito differs from Obturbans in the followir characters: it is smaller, much blacker, and has a pale patch of scales c the nape, and in place of the narrow creamy-yellow marginal line on t mesonotum of the male there is a brilliant silvery line, at least three tim as broad as that on the male of Obturbans. The male claspers are denta as in Obturbans and the larvæ have the greatly developed anal fla characteristic of the larvæ of the genus.

DESVOIDYA FUSCA.—*Theobald.*

"Head black with white border to the eyes and a white median patc Thorax deep brown with rich brown scales and pale side line; pleurae wit white patches. Abdomen coal-black with white lateral basal spots not see dorsally. Legs jet-black no white knee spots. Wings much as in Obturban but the cross veins different. Male palpi with the apical joint markedl shorter than the penultimate.

Female Head.—"Clothed with flat black and white scales, the whit around the eyes and in the middle and a small patch on each side; palp and proboscis black, the apex of the former apparently with some whit scales.

"Thorax black with narrow-curved flattish bronzy scales; prothoraci lobes with white scales and also a few white scales laterally especially a the base of the wing; pleurae brown with four prominent silvery-whit patches; scutellum brown with small flat black scales and black borde bristles; metanotum brown.

"Abdomen jet-black with basal white lateral spots almost extendin along the sides as a line; venter mostly white scaled.

"Legs with brown coxae with white scales, bases of the fermora white remainder jet-black; hind tibiae longer than the hind metatarsi; ungues o fore and mid legs equal and uni-serrated, hind equal and simple.

"Wings with the fork-cells small very slightly longer than the second posterior cell also very slightly narrower its base nearer the apex of the wing, its stem nearly equal to its length; stem of the second posterior about two-thirds the length of the cell; posterior cross vein about its own length distant from the mid.

Male.—"Head, thorax and abdomen as in the female; palpi black similar to D. Obturbans but the apical joint not as long as the penultimate; fore ungues unequal both uni-serrated mid more or less equal one toothed and of usual form the other contorted and apparently simple; posterior tibia longer than the metatarsi.

Occurrence.—"Closely related to D. Obturbans and Panalectros but smaller and the male has the apical palpal joint shorter than the penulti-mate; in panalectros the two joints are about equal in Obturbans the apical is slightly longer but especially differs in having curious mid ungues."

This description is drawn up from specimens sent by Dr. Durham ed from larvae taken in Kuala Lumpur and at Jugra.

Remarks.—The foregoing is from Theobald. I am unable to recognize e type. My types with white knee spots which I take to be Obturbans ave a pale spot in the centre of the head so that except for the difference in the lative lengths of the two last palpal joints in the male and the mid ungues iere is absolutely no difference between this mosquito and my types Obturbans. Neither do I consider the length of palpal joints in a y specimen to be a point of the slightest value when one observes ow differently parts of a mosquito are affected by drying. My ecies of Obturbans shew the two last joints about equal but in one two there is a difference in length due to unequal shrinking. he mid ungues figured for D. Fusca I believe to be an abnormal distor- on and curiously enough one of the females of Obturbans I have has an nguis with three teeth clearly an abnormality but not such as would arrant the separation of it as a distinct species. Again my Jugraensis gree with D. Fusca in having no white knee spots but it differs in having o pale patch on the head and last two joints of the male palpi are of equal ngth and the male thoracic ornamentation is far too distinctive not to ave been mentioned had it been described as Fusca. When it is remem- ered that I have taken large series of members of this genus have again nd again come across their larvae and actually found larvae in the very pot at Jugra where Dr. Durham obtained his larva it is very unlikely I hould have failed to obtain some of the same larvae he found. For the bove reasons I am of the opinion that D. Fusca is a mere variety of Obturbans. It cannot be my Jugraensis as the description of the male is uite different. I have quoted this description from Theobald's "Mono- raph," but I cannot see after comparing the descriptions of this mosquito nd Obturbans any valid reason for separating the two. I have larvae of all he three species described here and these larvae differ from one another quite s much as the adults. Theobald does not mention the arrangements of airs on the head in the larva he describes for this reason I am unable to dentify it as it is the arrangement of the hairs on the head which is of pecific importance.

Desvoidya Aureolineata. n. sp.

Head clad with dark purple-brown scales with a creamy-yellow spot in he centre behind, a narrow creamy margin along the eyes, and pale scales ow down on the cheeks. Thorax with a narrow margin of golden-yellow cales running right round the portion in front of the wings, two golden-brown lines in the centre in front and two behind opposite lateral lobes of scutellum and running forwards to a point outside each anterior line where they curve outwards to the margin. Abdomen dark purple-brown above with large triangular creamy lateral spots. Legs unbanded.

Female Head.—Along the orbital margins is a row of creamy-yellow scales forming a very narrow margin, behind in the centre is a round patch of creamy-yellow scales some of which are narrow curved, the rest of the head above and at the sides is clad with large square-ended spatulate scales of a rich dark velvety-brown colour with purple reflections, and outside these is a lateral band of white scales; a patch of light brown upright forked scales

is present on the nape; orbital and vertical bristles light brown. Basal joint of antenna ferruginous with a tuft of spatulate scales on the inner face dark brown above creamy below, which scales project well beyond the joint forming a distinct peak, second joint pale yellowish-brown at the base, dusky beyond, scaled on its inner face, remaining joints dusky except where the verticils are inserted where they are colourless, clad with white down and dark brown verticillate hairs. Clypeus blue-black. Palpi about one-fifth the length of the proboscis clad with rich brown scales purple in some lights, joints indeterminate. Proboscis purple scaled of moderate length and thickness with three or four long bristles inserted on the under part of the base and forming a sort of band.

Thorax.—Prothoracic lobes clad with scales which are flat spatulate creamy-yellow scales on the antero-external half and dark brown narrow-curved on the posterior half above and silvery spatulate below. Mesonotum purple-brown, running round the margin of the portion in front of the wings is a line of creamy-yellow very broad curved scales which over the shoulders bends inwards; passing down on either side of the centre in front is a narrow line of golden-brown scales which ends opposite a line joining the wing bases, and at this a single central line of golden scales starts and runs backwards to the centre of the base of the scutellum while from each lateral lobe a golden-brown line runs forwards and about half way across curves abruptly outwards and joins the marginal line just where it bends in; the rest of the mesonotum is clad with rich metallic-bronze narrow-curved scales. Scutellum yellowish-brown clad with large spatulate scales with square ends of a rich purple-brown colour; in the centre of the central lobe is a line of creamy-yellow scales continuous with the central line on the mesonotum. Pleurae brown with dark purple-brown spots clad with large creamy flat scales and lines of golden bristles. Wings brown with dark brown scales, the median long and elliptical, the lateral on branches of first fork cell, larger than scales elsewhere being elliptical at the base and clavate at the apex, those on veins posterior to this broadly linear; fork cells of moderate length, first narrower, but little longer than second, its base nearer wing apex, its stem a trifle shorter than the cell; third long vein carried unscaled beyond the transverse veins almost to the base of the wing; posterior transverse vein about as long as the median and distant rather more than its own length from it. Coxae brown with creamy flat scales and golden bristles; under sides of femora creamy scaled the hind femora with creamy scales all round except for a narrow line of dark scales above; the remainder of all the legs with rich dark bronze-purple scales; hind tibiae with rows of long golden spines; fore and mid ungues equal and uniserrate hind equal and simple.

Abdomen with rich purple-brown or bronze scales above. Laterally there are large triangular creamy spots the apex of the triangle looking obliquely upwards and backwards. The base of the triangle is nearer the base of segment. The venter of each segment has a broad band of creamy scales which occupies the whole of the segment except a narrow apical band of dark purple-brown scales. On the second segment there are only white scales and on the seventh the white scales are confined to the centre the apex and base being dark scaled.

Occurrence.—Described from a series bred from larvae found in water ollected in the shells of a fruit in the jungle at Ampang.

Remarks.—A very distinct Desvoidya. The golden lines on the thorax re much better marked in some specimens than others. It is a typical)esvoidya as regards its larva and the dentate male claspers but the side iarkings on the abdomen are peculiar and closely resembles that seen on iembers of the genus Leicesteria.*

Genus 7.—**Stegomyia.**—*Theobald.*

Head clothed entirely with large spatulate and upright scales confined o the nape. Palpi in the male slender and not hairy, as long as, or shorter nan the proboscis. Scutellum with large spatulate scales. Wings vith linear lateral scales rather broader than those on a typical culex wing. Most of the species black with white spots, lines, or bands. Thorax with iair-like scales and patches of broad scales on the shoulders.

Remarks.—The above is modified from Theobald. This genus is well epresented here and the species are easily recognised mosquitoes always lark coloured and usually ornamentated with white. They are mostly vicious biters and the majority of them are sylvan for though S. Scutellaris is often caught in houses it is far commoner in the jungle where it is i very troublesome pest.

Synoptic Table of Malayan Stegomyia.

I.—Legs Banded.

(*a*). Last two tarsal joints of hind legs white.

(1) Thorax with two white lines in front.....S. Gracilis.

(2) Thorax with one broad median stripe.....S. Perplexa.

(*b*). Hind legs with last joint only white.

(3) Thorax with two white stripes in front and curved stripes at side .....S. Fasciata.

(4) Thorax with central white stripe .....S. Scutellaris.

II.—Legs unbanded.

(5) Thorax in the female with two large patches of white on the anterior half in the male with the whole anterior half white scaled.....S. Nivea.

(6) Thorax with four large white spots.....S. Imitator. †

(7) Thorax in the female black scaled in the male black with golden lines.....S. Dissimilis.

(8) Thorax unadorned in male and female.....S. Fusca.

Stegomyia Gracilis. n. sp.

Thorax black with two silvery lines in the centre in front three behind terminating in three white spots on the scutellum. Head alternately black and white scaled. White lateral spots on the abdomen. Hind legs much

* The description of the male has unfortunately been left out and will be found on slip at the end under "Addenda."

† This species should come under the banded leg series.

banded two last tarsal joints pure white. A very slender mosquito of small size. A severe day biter.

Female Head.—Black compressed laterally and elongated longitudinally giving it the shape of an oblong; a band of broad flat white scales runs backwards from the vertex and ends just in front of the occipital foramen, on either side of this is a crescentic patch of black scales followed by a band of white then of black scales under parts being white scaled; there is a narrow line of white scales along the orbital margins, and a few rows of black upright scales on the nape, very difficult to see owing to the arching of the thorax over the head, which extend but a very little way laterally. Basal joint of antenna black, thickly clad with broad white scales which extend round the whole joint except for a small space on the outer surface, second joint black, with some small black scales on its inner face, remaining joints black with a white tomentum; verticillate hairs black. Clypeus black and nude. Palpi black scaled over the basal two-thirds white scaled on the apical third, joints indistinguishable. Proboscis enlarged apically, black scaled.

Thorax.—Prothoracic lobes black, on the outer face superiorly is a patch of broad snowy-white scales with rounded ends, above in front of these are some black bristles. Mesonotum black. A band of snowy-white scales runs round the whole anterior margin in front of the wings on the anterior half, on either side of the middle line are two narrow lines of white scales which extend about half-way across the mesonotum; on either side the marginal line of white scales just in front of the wing roots spreads inwards and forms a broad white patch; on the posterior half are three white lines which terminate opposite the white scutellar spots; the rest of the mesonotum is covered with bronze-black narrow curved scales. Scutellum black with a round patch of broad white scales on each lobe, separated by bare spaces. Pleuræ black with four patches of broad white scales. Wings with costa to first longitudinal vein very heavily scaled with broad spatulate black scales which like all the black scales on this mosquito have a purple hue in a good light, the other veins have a double row of rather long spatulate median scales and on their apical halves long narrow lateral scales, the lower branch of the fifth and sixth veins have no lateral scales; first fork cell longer and narrower than second posterior, its base nearer the base of the wing, its stem a little shorter than the cell; supernumerary and mid cross veins meet an angle; posterior about three times its own length from mid. Coxæ black with patches of white scales on their outer face, fore coxæ clad with black scales in front and there are three long bristles at the apex of each; there is a row of pale bristles on the posterior face of each hind coxa. Fore leg: femora black scaled with a narrow line of white scales more or less perfect on the interior face, tibia black scaled with a ring of white scales at junction of basal and middle thirds, metatarsus black scaled with a broad basal band of white, tarsus black scaled except for a band of white on first tarsal joint; mid leg similarly scaled with the addition of two white spots on the anterior face of the femora and a white ring at the apex; ungues equal and uni-serrate on both legs the tooth being very small. Hind legs, with basal half of femora clad with silvery-white scales, which extend further beneath and laterally than above,

ıe apical half is white beneath, but above, the white is confined to the nmediate apex; the white band on the tibia is broader than on the mid gs; the metatarsus and first two tarsal joints broadly banded white; st two tarsal joints entirely white, ungues equal and simple.

Abdomen.—Clad dorsally with purple-black scales. In some specimens ıere is a band of white scales at the base of each segment after the first, ut the other specimens shew very imperfect basal bands there being but few scattered scales on the segment except the penultimate which lways shews a large white basal spot. There are large square basal white pots laterally and the venter shews white basal bands except on the last wo segments.

Male Head.—Similar to the female. Antennæ plumose the plumes being urplish-black, and the joints are black where the plumes are inserted pale t the apex. Palpi about as long as the proboscis slender and without ristles, black scaled except for a patch of white scales on the upper sur-ace near the base of the first apparent joint and white basal bands on the econd and third joints. In all other respects the male resembles the emale.

Occurrence.—Larvæ taken from water in bamboos. Adults numerous n bamboo jungle.

Remarks.—In some respects the banding of the thorax resembles S. Fasciata but it lacks the crescentic bands at the sides these being re-laced by a straight line of white and a mass of white scales over the oots of the wings. The two central stripes end at a line joining the wing oots and do not run right back to the scutellum. The banding of the ıind leg is quite different for in Gracilis there is a band in the middle of he tibia not present in Fasciata and the two last tarsal joints on the hind eg are pure white in Gracilis only the last being white in Fasciata. Gracilis is also much more slenderly built.

Stegomyia Perplexa. n. sp.

Head with a broad white central band and narrow lateral white bands with black scales between. Basal joint of antennae white scaled and palpi with snowy-white tips. Thorax black scaled with a median line of silvery-white scales broader in front than behind and a broad margin of snowy-white flat scales and a few broad flat spatulate scales white in colour at the base of the scutellum in the middle line. Middle lobe of scutellum white scaled. Abdomen clad with black with basal white bands and large lateral spots. Legs black with one white band on the fore leg two on the mid and two on the hind, the two last hind tarsi pure white.

Female Head.—Clad with large flat scales with truncated ends arranged as follows:—In the centre a triangular patch of white broadest at the vertex narrowing on the occiput and ending before it reaches the margin of the occipital foramen, on either side of this a broad band of black scales succeeded by a narrow band of white followed by black and again by white; a narrow band of white narrow-curved scales runs along the orbital margin of either side; behind on the nape are two or three rows of black upright scales difficult to see unless the head is bent downwards to expose

the back of the occiput. Basal joint of antenna black completely clad with flat silvery scales, second and third joints black with a few small scales on their inner faces, remaining joints black with numerous short silvery hairs and black verticillate hairs. Clypeus black. Palpi about one-sixth the length of the proboscis apparently four-jointed clad with black scales except on the upper surface of the apical half which is snowy-white. Proboscis black scaled not as long as the abdomen.

Thorax.—Prothoracic lobes black, clad with small flat silvery scales and numerous long black bristles. Mesonotum black; in the centre is a broad band of long silky-white narrow scales running the whole length broader in front than behind, and at the base of the scutellum formed by broad spatulate scales. Round the margin of all the portion between the prothoracic lobe and the wing root of each side is a band of flat white scales which over the wing roots are clavate towards the front shorter and more spatulate. These scales are distinctly on the mesonotum and though below they mingle with the pleural scales they are really inserted on the mesonotum and not on the pleurae. The rest of the mesonotum is clad with black narrow-curved scales with bronze tints in a good light. The scutellum is clad with rather small spatulate scales set in imbricate rows and covering nearly the whole surface, they are silvery in the centre black at the sides. Pleurae black with large patches of flat silvery scales. Wings heavily clad with dark brown scales, median small and narrow with square ends, lateral linear with rounded ends; fork cells of about equal breadth, first longer than second, its base nearer the wing base, its stem about two-thirds the length of the cell; posterior cross-vein rather more than twice its own length from median. Coxae black with silvery scales; in the fore legs the femora are black scaled above and at the sides, silvery beneath, the tibia black, metatarsus black with narrow silvery basal band, and joints of the tarsus black; in the mid legs the femora are black above and at the sides silvery beneath and have a patch of silvery scales above and to the front at the extreme apex, tibia black scaled, metatarsus and first tarsal joint with basal silvery band, remainder black; in the hind leg the femur is clad with silvery scales except above and laterally on the apical third, the tibia is black scaled with silvery spines and the metatarsus black with broad silvery basal band; first tarsal joint silvery for the basal half black on the apical, second joint black throughout, last two joints silvery, fore and mid ungues equal and uni-serrate.

Abdomen clad with black scales, all segments after the second with narrow basal silvery band and all segments with large square silvery lateral spots, venter with basal bands to segments.

Male.—With plumose antennae, plumes steel-grey, joints black and white except the basal which is black with white scales. Palpi about four-fifths the length of the proboscis very slender and without hairs, with a broad silvery band about the centre of the antepenultimate joint. Proboscis black. Bases of fork cells nearly level, second broader than the first. Legs, abdomen and thorax scaled as in the female.

Occurrence.—Described from several females taken in the jungle five miles from Kuala Lumpur and one male and female from the jungle at "The Gap."

Remarks.—This mosquito is somewhat difficult to place as it very osely resembles the genus Stegomyia and in some respects the genus cutomyia founded by Mr. Theobald on a specimen of Scutomyia Albolieata I sent him which I took here, but I have placed it in this genus ough it differs in the following points the flat scales on the head are much naller and have more rounded ends than those on the head of a typical egomyia, there is a distinct row of narrow curved scales along the orbital argin but none on the vertex as in Scutomyia, the scutellar scales are naller than those of stegomyia, the proboscis is relatively longer, and the ody more slender. It resembles Scutellaris at a glance even more than cutomyia Albolineata does, as the banding of the hind leg is very similar, it the single white scutellar spot at once distinguishes it. From Scutomyia lbolineata it is easily distinguished by the banding of the hind legs the reater breadth of the central white thoracic band and the ovoid shape of iat band. The time of capture was May at "The Gap," October and lovember in the jungle on the Pahang Road near Kuala Lumpur. I ave sometimes wondered whether this species could be a hybrid as the esult of the crossing of a male Stegomyia with a female Scutomyia Albolieata. I once caught such a pair copulating but the female unfortunately ied without laying eggs.

Stegomyia Fasciata.—*Fabricius.*

Head with black spatulate scales a white central and two lateral hite bands on either side. Thorax with two narrow central white stripes nd a broad silvery lateral stripe which forms a crescentric band on the nterior two-thirds and a straight line on the posterior third. Abdomen anded and with snowy-white lateral spots. Legs banded.

Female Head.—Black; a bare line in the centre, on either side silvery cales outside these on either side brown then white then brown followed y white bands; the blackish-brown bands are the broadest. Basal joint f antenna black with silvery scales, remaining joints black with black erticils. Clypeus black with two small patches of silvery spatulate scales. Palpi black scaled at the base with brilliant silvery scales at the apex. Proboscis clad with black scales.

Thorax.—Prothoracic lobes black, clad with silvery elliptical scales. Mesonotum black with two very narrow central stripes of silvery hairike scales; on the margin of the anterior two-third is a broad silvery crescentic band composed of short broad curved scales with pointed nds and joining the hinder end of this crescent is a straight line of similar scales which runs back to the base of the scutellum; on either shoulder is a patch of creamy-yellow scales some narrow curved and some racquetshaped; the rest of the mesonotum is clad with bright bronze hair-like scales. Scutellum black, each lobe clad with a large patch of white spatulate scales. Pleuræ black with several patches of broad silvery scales. Wings brown with dark brown scales, the lateral scales are long linear scales; fork cells long, first longer than the second, its base nearer the wing base, its stem about one-third the length of the cell; posterior crossvein rather more than twice its length from the median. Coxae dark brown with silvery scales; femora silvery beneath and at the sides in

the hind and less so in the mid femora; knee spots white. Narrow basa band to metatarsus and first tarsal joint of fore and mid legs, broad basa bands to metatarsus and all tarsal joints of the hind legs. This type evidently is the variety known as Luciencis as the black band at the tip of last tarsal joint is very evident. Other specimens shew a pure white last tarsal joint and yet both the specimens were taken in the same water.

Abdomen.—Black above with narrow basal bands with a yellowish tinge and snowy-white triangular lateral spots and white ventral bands Fore and mid ungues equal and uni-serrate.

Male.—The male has very densely plumose antennæ the hairs being exceptionally long especially on the outer side. The colour is deep brown The palpi are longer than the proboscis and shew two basal white bands and a white band at the base of the ultimate and the penultimate joint The fore and mid ungues unequal and there is a tooth on the larger unguis of the fore leg, but not on that of the mid leg.

Occurrence.—Larvæ taken in bath tubs in house at Klang, Singapore Penang, and Pangkor Laut, etc.

Remarks.—It is somewhat remarkable that in a mosquito described as often and by so many different observers as this mosquito the dense scaling on the clypeus should have received no mention. It is one of the points of difference between this fly and S. Scutellaris which is said to be closely allied. In Malaya the distribution of this mosquito differs from that of Scutellaris for while the latter is found practically all over the Peninsula S. Fasciata has so far only been taken along the coast, I have never found it further inland than Klang and this town lies on the bank of a tidal river. The variety S. Luciencis occurs here and the variation must be of very slight importance as flies with pure white last tarsal joint of the hind legs and those with a black band on the last joint hatched out from the same batch of larvæ.

Stegomyia Scutellaris.—*Walker.*

Head with a broad snowy central stripe and two snowy-white lateral spots on either side. Thorax with broad median silvery stripe on anterior two-third and three narrow white stripes on posterior third. Abdomen basally banded, and with lateral spots. Hind tarsus with five white bands

Female Head.—Black; in the centre is a band of silvery scales which in front are almost spindle-shaped behind broad spatulate; on either orbital margin near the vertex are a few spindle-shaped silvery scales; on either side of the central band is a patch of coal-black spatulate scales succeeded laterally by white then black followed by white patches of scales in the order given; on the nape are a few rows of black upright scales. Basal joint of antenna coal black clad with brilliant silvery scales. Palpi black at the base with silvery scales at the apex. Proboscis black.

Thorax.—Prothoracic lobes black with brilliant silvery elliptical scales Mesonotum black; in the centre is a broad band of silvery hair-like scales extending two-thirds of the way, beyond this the line gets very narrow and just before reaching the scutellum forks enclosing a bare space; on either side of this is a narrow silvery line running forwards from

ıe lateral lobes of the scutellum for one-third of the distance of the ıesonotum. The rest of the mesonotum except the shoulders which are lad with silvery elliptical scales, is clad with bright bronze hair-like scales. There is a short silvery line over the root of each wing composed of fusiform cales. Scutellum black each lobe entirely concealed by a covering of ilvery clavate scales. The scutellar and mesonotal bristles blackish-brown. Pleurae black with patches of clavate silvery scales. Wings brown with ark brown scales the lateral ones being linear with rounded ends; fork ells long, first longer than the second, its base nearer the wing base, its tem a little more than half the length of the cell; posterior cross vein hree times its own length from the median. Coxæ dark brown with silvery cales. Fore legs with a narrow silvery line on the venter of the femora a ilvery spot at the apex of each femur and a narrow silvery band at the ›ase of the metatarsus and first tarsal joint the rest clad with coal-black ;cales; the mid leg is the same with more white on the femur especially at ts base; hind femur with silvery band at its base silvery scales beneath ınd a line of silvery scales on the sides and a broad patch at its apex the est being black; tibia black scaled with rows of short silvery spines; netatarsus and first three tarsal joints with broad silvery basal bands, last arsal joint pure white.

Abdomen.—Coal black above with narrow silvery basal bands, large silvery lateral spots and silvery bands on the venter.

Male Head.—With scales similar to the female. Antennæ densely plumose with olive-brown plumes. Palpi slender, longer than the proboscis by their last jont clad with black scales with four silvery bands, two on the first joint and one narrow one at base of penultimate and ultimate joints. In all other respects the male resembles the female. Fore and mid ungues unequal the larger with a tooth.

Occurrence.—Larvæ common in bath tubs in houses and exceedingly common in banboos in the jungle. Adults common in houses especially where such are near small patches of jungle or undergrowth.

Remarks.—Although described in THEOBALD'S "Monograph" I have redescribed thismosquito as there are a few points apparently unnoticed in THEOBALD'S description probably because his specimens have not been quite perfect. Nomention is made of the difference in the shape of the scales in the median white band on the head from the spatulate black scales at the sides. Again the three silvery lines on the posterior third of mesonotum are not mentioned or the patches of elliptical scales on the shoulders and over the roots of the wings. This is a very widely distributed and common mosquito the larvæ being found in small collections of water almost everywhere.

STEGOMYIA NIVEA.—*Ludlow.*

A rather small stout mosquito with a conspicuous broad white band on either side of the anterior thorax. Legs unbanded. Basal half of hind femora white.

Femal Head.—Black. Covered entirely with broad flat scales with truncated ends; a small patch of white scales on the vertex; behind this a

broad round patch of black scales, and on either side of this the scales are pale brown or a sort of drab; there is a margin of pale scales along the eyes best seen with a hand lens. By altering the position with regard to the direction of the light the colour of the scales alter those in the centre showing a rose-purple tinge and the brown scales acquiring a silvery lustre. Behind on the nape are several rows of dark-brown upright forked scales but these do not extend far forwards and as the head is set very close to the thorax they are sometimes difficult to see. When dry the dark scales lose colour and become brown. Vertical bristles pale-brown. Orbital dark-brown.

Basal joint of antenna black; naked, all succeeding joints black, except where the verticils are inserted, with short white hairs; verticils black. Clypeus black and nude. Palpi entirely purple-black scaled rather short. Proboscis purple-black scaled swollen at the end.

Thorax.—Prothoracic lobes, prominent and black beset with numerous black bristles and clad with a few broad white scales. Mesonotum dark grey to black, the anterior half clad with silky white narrow-curved scales on either side, and a band of bronze scales running up the centre sometimes as far as the anterior margin thus dividing the white scales into two large patches but in other specimens it stops short of this and the white scales are inserted along the whole anterior margin and form with the two lateral patches a V-shaped patch. The posterior half of the mesonotum is clad with bronzy scales. Over the wing root is a line of bristles dark brown almost black in colour. The patches of yellow scales seen in the male appear to be absent on the posterior part of the female thorax. Scutellum densely clad with broad flat black scales with truncated ends; scutellar bristles dark purple-brown. Wings brown, covered with dark brown scales, linear lateral ones and rather long narrow median ones; fork cells moderately long of about equal width, base of second nearer wing base, stem of first about two-thirds length of cell; supernumerary cross-vein a little nearer base of wing than median, posterior cross-vein about twice its length from median. Pleuræ almost black with a brownish tinge with patches of silvery-white scales. Fore and mid coxæ dark brown, hind coxæ paler brown; fore and mid femora with a few white scales beneath with a pearly lustre the rest of the femur with the whole of the tibia and tarsi scaled with purple-black scales. In some specimens the mid femora has a white patch of scales on its anterior face a little before its apex. Hind femora white beneath and laterally for about three-fourth their length, scaled purple-black beyond; rest of the leg scaled purple-black. Fore and mid ungues equal minutely uni-serrate. Metanotum chestnut-brown. Halteres creamy-yellow stems and black heads.

Abdomen.—Dorsally scaled with purple-black scales. On the penultimate and antepenultimate segments the white lateral spots spread on to the dorsum and almost meet giving the appearances of a basal white band; laterally there are large square basal spots of white scales having a pearly lustre; ventrally there are broad white basal bands.

Male Head.—Dark brown, clad entirely with flat scales and upright forked behind. Under a hand lens the colour of these scales varies considerably according to the amount and position of the light at one time all

appear purple with a pale silvery orbital margin or again the central only may appear purple the lateral areas then appearing of a silvery-brown. Under a 2/3 in a good light there is a central triangular area of pale black scales surrounded at the sides and behind with silvery-brown scales; on the nape these scales become darker and here are inserted a few rows of dark brown upright forked scales and there are a few golden upright forked scales immediately behind the orbital bristles. Vertical and orbital bristles brown in a good light pale brown. In a poor light the lateral brown scales on the head shew no silvery lustre. In most of my dried specimens the scales on the orbital margin are silvery-white and all the rest are light brown there being no appearance of the black scales. On comparing a fresh with a dried specimen there is a very great difference noticeable the purple predominating in the fresh the brown in the dried. Basal joint of antenna black without scales, remaining joints black at the base colourless at the apex; plumes purple-brown with pale tips. Palpi as long as the proboscis clad with purple-black scales two last joints hairy. Proboscis slightly enlarged apically, clad with purple-black scales.

Thorax.—Prothoracic lobes with some dark brown bristles inserted on the superior surface and a patch of broad white scales on the upper part of the outer face. Mesonotum with the anterior half covered with long silky pearly-white narrow curved scales which are imbricated and have the appearance of the scales on a fish, behind these the scales are purple-black with two patches light yellowish-brown scales placed one on either side immediately behind the bare patch on the scutellum between the central and lateral lobe. In the dry specimen the purple scales may fade and become light brown and in one specimen there are some white scales in the middle line in front of the scutellum. Scutellum black, central and lateral lobes clad with three patches of broad flat scales with truncated ends light yellowish-brown in colour with one or two pale black scales interspread; scutellar bristles pale yellowish-brown. Wings more lightly scaled as is usual in the male. Legs as in the female. Fore and mid tarsi unequal larger claw uni-serrate.

Abdomen.—Lateral spots smaller and more triangular.

Occurrence.—Described from a series some of which were bred from larvæ found in the water in cut bamboos, the others, adults, caught in the jungle.

Remarks.—Entirely sylvan though appearing in houses close to jungle. It is a fairly common mosquito and a vicious biter. Easily recognised by the thoracic ornamentation which is quite unlike any other Malayan species except S. Imitator, but the latter has four patches of white on the mesonotum and not two as in Nivea.

Stegomyia Imitator. n. sp.

Head with diamond-shaped silvery patch on the vertex, white lateral bands and brown scales elsewhere, which scales in some lights shew bronze-green and purple tints. Anterior fourth of mesonotum clad with silvery scales and a transverse bar of silvery scales on either side in front of the wings and metallic-bronze scales over the rest of its surface.

Scutellum entirely white scaled. Abdomen with lateral spots. Fore legs with basal white bands to metatarsus and first tarsal joint; mid legs with white spot about the middle of femora and white scales at the apex and tarsus banded as in the fore leg; basal two-third of hind femora white, metatarsus and first three tarsal joints with basal white bands.

Female Head.—Black; on the vertex is a large diamond-shaped patch of silvery scales, on either side of this are dark scales which appear black under a hand lens but under a 2/3 vary with the light, in a good light shewing bronze-green tints: the real colour of the scale if seen singly and not massed is olive-brown. On either side of these dark scales is a band of white scales followed by a band of dark scales succeeded by white, and along the orbital margin of either side is a single row of small white clavate scales. The head scales are not so broad as those on most stegomyia. Between the eyes the white scales are small and lanceolate. There are a few upright scales on the extreme margin of the occiput seen with great difficulty in the type but still quite evident; orbital and vertical bristles brown. Basal joint of antenna black, clad all round except outside with small silvery spindle-shaped scales, second joint with a few dark scales, remaining joints dark blackish-brown with black verticillate hairs. Clypeus black. Palpi about one-fourth the length of the proboscis, black, for the basal two-thirds, silvery on the apical third. Proboscis about as long as the abdomen, black.

Thorax.—Prothoracic lobes black, clad with spindle-shaped silvery scales. Mesonotum black; shoulders clad with silvery spindle-shaped scales, anterior fourth covered with long silvery narrow-curved scales while a band of silvery scales extend transversely inwards from the root of the wing on either side for about one-third the total breadth, the rest of the mesonotum is covered with metallic-bronze narrow-curved scales. Scutellum light brown, narrower than the base of the mesonotum, clad with three patches of small flat silvery scales: these scales are relatively much smaller than in most stegomyiae and their ends are more rounded. Scutellar bristles dark brown; there appear to be only two central bristles and it does not look as though any were knocked off. One specimen shews two the other two large and one small one. Pleurae black with patches of silvery flat scales. Wings clad with dark brown scales of the usual type linear lateral, median narrow spatulate, first fork cell narrower and slightly longer than second, their bases about level, the stem of the first fork cell about half the length of the cell; posterior cross-vein about twice its own length from the median. Coxae dark brown clad with silvery flat scales; femora and tibiae of fore legs black scaled, metatarsus and tarsus black scaled with a basal white band on the metatarsus and first tarsal joint; mid leg scaled like the fore leg except for a large silvery spot about the middle of the anterior surface of, and a patch of silvery scales at the apex of each femur; basal two-thirds of hind femora silvery-white, apical third black, with a patch of white at the apex above and below; tibia black scaled; rest of leg black scaled with basal band on metatarsus and first three tarsal joints; fore and mid ungues equal uni-serrate, hind equal and simple.

Abdomen.—Black scaled with traces of snowy basal bands on the apical segments and large lateral spots which diminish in size from base to apex; venter retracted and invisible.

Occurrence.—Described from two females both taken in jungle off the Gombak Road five miles from Kuala Lumpur. This patch of jungle is the only place I have ever seen this mosquito for though I have only two specimens preserved I have taken several but always in the same place.

Remarks.—In some respects it resembles S. Nivea but the white patch is broken up into three and is not one solid mass as in Nivea. It differs from S. Gubernatoris in the thoracic ornamentation, in the leg banding and the colour of the scales on the scutellum. It is a robustly built insect having a very broad thorax and is a fairly typical stegomyia though the head and scutellar scales are not nearly as broad as those in similar situations on Scutellaris and S. Fasciata. The specimens were captured in the early part of the year in February and March.

Stegomyia Dissimilis. n. sp.

A medium-sized slender mosquito with a black scaled thorax in the female and a golden scaled one in the male. The fore and mid legs are unbanded; the hind thighs are white basally and at the apex. The abdomen is unbanded dorsally but basally banded ventrally with large square pearly-white spots laterally.

Female Head—Black, entirely flat scaled; in the centre is a large elliptical patch of purple-black, on the vertex is a triangular patch of broad white scales and from this a narrow band of white scales runs outwards on either side along the orbital margins to a lateral patch of pale scales which run backwards to the occipital foramen and laterally as far round as one can see; towards the front these scales are pearly-white but behind they are a pale golden-brown: there is a small spot of purple scales placed against the eye on either side, which varies in size even on the two sides in the same specimen on one side of the specimen here described it is very small while on the other side it is much larger triangular in shape and divides the large patch of pale scales into two; on the nape there are inserted about three rows of brown upright forked scales; the vertical bristles are dark brown, the orbital pale brown. Basal joint of antenna black and nude, second joint pale brown at the base black apically, and swollen in the middle where there is a ring of small black spatulate scales inserted, remaining joints entirely black clothed with numerous white hairs; verticillate hairs, purple-black with pale tips. Clypeus black, strongly ridged transversely; nude. Palpi scaled with purple-black scales, with a few strong hairs inserted on the basal joints. Proboscis scaled like the palpi; labellæ black.

Thorax.—Prothoracic lobes black, with several strong dark brown or black bristles inserted on the upper surface and a patch of pearly-white broad scales inserted on the lower half of the outer face. Mesonotum black, with a large quadrangular patch of broad pearly-white scales inserted on the shoulders, and a small elliptical patch of similar scales in front of the wing base, the rest of the mesonotum being covered with narrow-curved scales chiefly purple-black though there are some golden-brown scales

especially towards the centre. The specimen is somewhat rubbed, but a slight examination made just after the fly had emerged satisfied me there is none of the distinct golden banding seen in the male. The alar bristles are strongly marked and dark brown in colour. Scutellum black, with three patches of purple-black broad flat scales: scutellar bristles brown. Pleuræ black with three patches of pearly-white scales, one small patch above the fore coxa, one large patch between fore and mid coxæ and a third small patch above the hind coxa. Wings dark, clad with purple-black scales, the median long and narrow with square ends the lateral lanceolate; first fork cell longer and slightly narrower than second, its base nearer base of wing, its stem about two-third the length of the cell; mid and supernumerary cross-veins meeting at an open angle, posterior cross-vein rather more than its own length distant from mid. Fore coxæ black basally, pale yellow-brown apically, mid and hind coxæ black paler on the inner faces; a patch of white scales on the anterior surface of fore coxæ and outer surface of mid coxae; trochanters of all legs pale yellow-brown with pale scales; fore legs entirely purple scaled, mid purple scaled except for a long patch of white scales on the under surface of the femora in the middle; hind femora white scaled for the basal two-thirds and for the apical fifth purple scaled between. On the underside the white scaling extends further than on the upper and lateral surfaces; tibiæ and tarsi purple scaled; fore and mid ungues equal and uni-serrate. Metanotum dark brown; halteres with pale stems and black scaled knobs.

Abdomen.—Dorsally purple scaled, ventrally purple scaled with pearly-white basal bands to the segments. Square basal pearly-white lateral spots, are present on either side of each segment while the last segment has a basal white band.

Male.—With plumose antennae the plumes being deep black. The palpi are a little shorter than the proboscis very slender and entirely clad with black scales with purple reflections. The proboscis is as long as the whole body and more slender than is usual in members of this genus. The mesonotum bears the same white shoulder patches as the female but the rest of its surface is clad either entirely with golden scales or in some specimens with golden scales over the greater part of its surface the edges being black scaled. The fore and mid ungues are unequal and each unguis bears a tooth. In other respects the male resembles the female.

Occurrence.—Described from a series bred from water in the hollow of a tree in the jungle at Ampang.

Remarks.—There is no other Stegomyia this species can be confused with as the golden-scaled mesonotum in the male is quite a unique feature.

Stegomyia Fusca. n. sp.

Head clad in the centre with metallic purple-black flat scales: on either side of this is a narrow band of white scales and the portion of the orbital margin on the genal side of this band is bounded by a narrow line of white scales; black scales clothing the rest of the side of the head Thorax brownish-black with dark bronze scales. Abdomen clad with

purple-black scales and white triangular lateral spots. Legs all black except under sides of femora.

Female Head.—Clad with spatulate purple-black scales in the centre, a narrow white band on either side, succeeded by purple-black scales; the portion of orbital margin beyond the white band is bounded by a narrow line of white scales. Upright forked scales extend forwards to the vertex, they are dark brown in colour almost black behind on the nape; vertical and orbital bristles black. Basal joint of antenna black with a few small scales and hairs on its inner face, second joint pale at the base clad with some small almost spindle-shaped black scales which extend round on all sides of the joint, verticillate hairs on the joint very small, portion of joint beyond verticils black, remaining joints black except at the insertions of the verticillate hairs where they are colourless, clad with numerous white hairs; verticillate hairs black. Clypeus black; nude. Palpi with three apparent joints. Balsam preparation of palpi shews four joints, two first joints of about equal length; third larger and rather longer than second; fourth like a small nipple on the end of the third; the whole palpi rather less than one-fourth the length of the proboscis clad with black scales and some long black hairs. Proboscis as long as the abdomen, rather thick and clad with purple-black scales; labellae rather paler than the rest of the proboscis.

Thorax.—Prothoracic lobes dark brown, with a few spatulate scales inserted on the upper outer face which are almost white in colour and two rows of dark brown bristles. Mesonotum black thickly clad with narrow-curved scales which under a hand lens appear purple-bronze but under a 2/3 they look merely black. The bristles are large and black in colour. Scutellum black; the middle lobe is very large with concave margin and truncated apex, the lobes are clad with broad spatulate purple-black scales; scutellar bristles dark brown central lobe with five. Pleurae smoky-brown with patches of broad flat white scales. Wings long and rather narrow, clad with long narrow purple-black lateral scales which are very slightly enlarged at the apex and have rounded ends; the median scales are also long and narrow with oblique ends; fork cells long, the first being longer and narrower than the second and its base nearer the wing base; the stem of first fork cell is about two-thirds the length of the cell. Median transverse vein nearer wing apex than supernumerary, the posterior transverse vein is about three times its own length from the median. Coxae dusky brown with scales and hairs; fore femora clad with dark purple-brown scales above and laterally, and white scales beneath; mid and hind femora with dark scales above and at the apex laterally, white scales ventrally and laterally at the base; the tibia metatarsus and tarsi of all the legs clad with dark purple-brown scales and numerous short stiff hairs. Ungues equal those on the fore and mid legs shew a notch which can hardly be called a tooth.

Abdomen.—Above and laterally clad with purple-black scales. At the base of each segment after the first is a small spot of white scales. In some specimens these spots only shew on the third, fourth and fifth segments. The venter is pale scaled and numerous pale hairs fringe the segments ventrally.

Male.—Scaled as in the female. Antennae plumose with purple-black hairs; joints dusky at the base silvery at the apex. Palpi a little shorter than the proboscis black scaled and without hairs except on the apex of the terminal joint where there is one stout black hair and a few short slender hairs. In all other respects male resembles the female except that the fore and mid ungues are unequal but simple. Genitalia are rather complex but not easily seen.

Occurrence.—A small stegomyia bred from larvae taken from the water collected at the bases of the leaves of an atap palm in the mangrove swamp, Port Swettenham. The adult is a blood sucker and common in jungle where atap palms are common.

Genus 8.—**Leicesteria.**—*Theobald.*

Head with large spatulate scales and upright forked scales confined to the nape. Proboscis thick. Palpi more than half the length of the proboscis in the female, in the male very slender and longer than the proboscis by the last joint. Mesonotum clad with hair-like scales on the dorsum and large spatulate scales on the margins and in front of the scutellum. Scutellum with spatulate scales. Large mosquitoes with very long slender abdomens and with thorax arched forwards over the neck and head.

Remarks.—This genus is founded on specimens sent from here to Mr. Theobald. Four species have been found all easily recognised by the long female palpi a character which marks every species and distinguishes them from Desvoidya which they somewhat resemble. They are all sylvan vicious day biters and all appear to breed in the water in bamboos.

Leicesteria Longipalpis.—*Theobald.*

A slender rather small mosquito with unbanded legs but conspicuous white lateral bands to the abdomen. The female palpi are very long fully two-thirds the proboscis.

Female Head.—Black, the vertex occiput and nape covered with broad spatulate black scales, and along the orbital margin a narrow row of spindle-shaped creamy scales; laterally where the black scales end is a band of creamy scales and then black scales again. There is a moderate number of black upright forked scales confined to the nape. Basal joint of antenna pale dirty yellow, the inner face thickly clad with small flat scales with a few dark ones interspersed; the basal half of second joint is similar in colour to basal joint the apical half and the succeeding joints of the antennæ are black covered with numerous short white hairs; verticillate hairs black; last joints of antennæ not elongated. Clypeus dark brown with a few narrow white scales on its anterior margin. Palpi four-jointed clad with black scales, third joint very long, longer than all the other joints put together, fourth joint minute. The palpi in this species are unusually long being fully half the length of the proboscis. Proboscis thick clad with black scales.

Thorax.—Prothoracic lobes thickly clad with spatulate scales, white on the lower half, black above, while from the apex a tuft of

stout dark brown bristles projects. Mesonotum yellowish-brown with a band of creamy scales running round the anterior margin composed of broad curved scales in front and spatulate scales in front of the wings, the dorsum being clad with long narrow-curved bronzy scales which are specially dense and long over the roots of the wings where they form dense tufts. The colour of these scales under a hand lens is metallic-bronze but under a 2/3 many appear pale brown. In some lights they appear purple as do the dark scales on the head and proboscis, indeed the scales on this mosquito shew a play of colours on every part as the angle of the light changes. Pleuræ, brownish, clothed with tufts of white elliptical scales. Scutellum clad with spatulate black scales, purple or rose-purple in a good light on all three lobes; scutellar bristles brown. Wings clouded, covered with dark brown scales, the lateral linear with square ends, the median also rather narrow; fork cells moderately long, stem of first about two-thirds length of cell, the base of the cell nearer wing base than that of second. The second cell is a little broader than first. Median and supernumerary transverse veins meeting at an angle, posterior transverse vein rather short, distant about twice its length from median. Coxæ pale, fore and mid with brown and white scales the hind with only white scales; femora pale scaled beneath though on the fore legs there are dark brown scales intermingled; the rest of the legs and the upper surface of femora clad with scales dark brown or purple according to the direction of the light. There is no banding of the legs nor any suggestion of it. On the fore legs there are a few yellow scales at the apex of the tibia. The fore and mid ungues equal and uni-serrate. Metanotum yellowish-brown; halteres with pale stems and black and white scales on the head.

Abdomen.—Covered with broad purple-brown scales, without dorsal banding though the white lateral bands almost meet over the apices of the segments; laterally there are conspicuous white bands passing from beneath upwards and backwards, the upper edge of each band concave; the scales forming these band are bluish-white, but in the dried specimen they may change to a dirty yellow.

Male.—The lateral band of creamy scales on the head is broader than in the female. The vertical bristles are pale golden. The antennæ are pale brown, the two last joints being black and elongated and the plumes are long dense and purple-brown. Proboscis distinctly enlarged for about one-third its length at the apex, the whole clad with black scales. Palpi slender, longer than the proboscis scaled entirely (save for a few white scales about the centre of the first apparent joint) with dark purple-brown scales. Fore and mid ungues unequal larger uni-serrate.

Leicesteria Dolicocephala. n. sp.

Head compressed laterally somewhat square in shape with purple-black scales above sometimes with a narrow creamy line in the centre behind, and a creamy band laterally which is succeeded by a black band followed by creamy scales. A tuft of golden vertical bristles. Palpi more than half as long as proboscis. Thorax extended forwards over the head clad with bronzy scales and a margin of creamy-yellow spatulate scales. Abdomen

long and slender with peculiar shaped creamy lateral spots and golden spot more basally. Legs unbanded.

Female Head.—Compressed laterally and square in shape, upper surfac clad with dark purple-black scales sometimes shewing a short line behind o creamy scales, and laterally a creamy band followed by a black banc succeeded by creamy scales; there is a very narrow creamy margin to th eyes. The scales on the head are very large flat and square ended. Th colour varies with the light being black or purple or bronze. There are a few creamy upright scales behind on the nape. Vertical bristles pale golden Basal joint of antenna yellowish-brown with dark purple shading on th inner face. The inner half of this joint is much deeper from base to apex than the outer half and is densely scaled with small dark flat scales, secon joint pale yellow at the base, dark purple at the apex, with some flat scale inserted on the basal half, remaining joints dark purple with white down and dark verticillate hairs. Palpi rather more than half the length of th proboscis, four-jointed entirely clad with purple-bronze scales. Proboscis about two-thirds the length of the abdomen thick and clad with dark purpl scales.

Thorax.—Prothoracic lobes dark purple entirely covered with large creamy flat scales, there is also a row of long dark purple-brown bristles which curve outwards and backwards. The mesonotum arches forwards over the head in a manner very characteristic of the members of this genus it is dark purple in colour clad round the margin in front of the wings with a broad band of large spatulate creamy scales which on the shoulders swel into round patches, the remainder is covered with long narrow bronzy scales which in the centre are hair-like but are broader at the sides and in front of the scutellum where the scales become broad and spatulate Scutellum densely clad with large spatulate scales of a purple-brown colour with a line of creamy-yellow scales in the centre of the central lobe, bristles light-brown. At the bases of the wings on the mesonotum are dense tufts of what might be mistaken for blunt-ended bristles but under a fairly high power are seen to be scales with notched ends very much like upright forked scales of great length. Pleurae dark purple-brown with patches o white flat scales. Wings brown with dark brown scales with purple reflections; the median scales on the first fork cell and its stem consist of a double row of rather oblique-ended scales about twice as long as they are broad, elsewhere they are not so large; the lateral scales are long linear scales; first fork cell longer and narrower than the second, its base nearer the wing base, its stem a trifle more than half the length of the cell posterior cross-vein about one and a half times its own length from median Coxae dark brown thickly clad with snowy-white flat scales. Sides and venter of hind femora and venter of fore and mid silvery, the remainder o all legs clad with dark purple-brown scales. On the under surface of the hind tibia at the apex and the adjoining portion of the metatarsus is a fringe of long scales golden-brown in colour while at the extreme apex of the tibia is a tuft of golden spines; there are golden spines along the whole length o the tibia placed in rows; ungues equal and uni-serrate on fore and mid legs.

Abdomen.—Clad above with rich purple-brown scales. Laterally there are curved snowy-white bands directed upwards and backwards from th

ower part of the base of the segment and on all the segments but the two irst in front of the base of these bands there is a square spot of golden-ellow scales. The apical segments ventrally show three colours yellow at he base snowy-white in the middle and dark purple-brown at the apex.

Male.—The antennae are plumose the basal joint being brown with purple shading on the inner face and dark scales with silvery-white scales beneath and towards the outer face, remaining joints banded brown and white, the plumes being brown with purple sheen. Palpi longer than the proboscis, terminal joint slender and ending in a spine, a pale ring in the middle of the first apparent joint. Proboscis anterior quarter enlarged clad with dark purple scales. The whole of the central lobe of the scutellum white scaled. Fore ungues markedly uneven one being nearly three times the size of the other, both ungues toothed. Mid ungues nearly equal both uni-serrate. Hind equal and simple. In other respects the male resembles the female.

Occurrence.—I have taken this mosquito in jungle round Kuala Lumpur and also at Bukit Kutu; it is as far as I know entirely a bamboo breeder and it is a curious fact that where one species of the genus is common all the species are more or less common.

Remarks.—It is a vicious biter either during the day or towards sun-down and in certain localized areas I have known it occur in great numbers in association with the other members of this genus and Desvoidea. Curiously enough though I have often taken the larva of longipalpa I have scarcely ever found the larva of this and the next species though the adults are as common as the previous species. When inserting its proboscis this mosquito keeps its wings vibrating in a rather characteristic way. Another curious fact about it is the power it has of pushing itself through small holes. I have had it in cages with some of the Uranotænia, much smaller mosquitoes, and while none of the Uranotænia have attempted to get through the netting every one of this species has immediately pushed its way through the net. This is the only mosquito I have seen do this except Stegomyia Gracilis.

Leicesteria Cingulata. n. sp.

This species resembles L. Dolicocephala but there are distinct creamy apical bands on the dorsum of the abdominal segments. Head with spatulate scales dark purple-brown in the centre creamy at the sides with a dark brown line running through the middle of the creamy lateral patches. Thorax with bronzy scales and a pale golden-yellow margin. Legs unbanded scaled purple-brown. Lateral abdominal spots triangular those of opposite sides meeting on the dorsum to form creamy apical bands. Venter creamy-white. Clypeus scaled.

Female Head.—Clad with dark brown scales in the centre which in some lights are purple; along the orbital margin of either side is a narrow creamy line and laterally the scales are creamy crossed from before backwards by a band of dark brown scales; on the nape is a very ill-defined patch of scales which under a hand lens appear creamy but under a 2/3 are a dirty yellowish-brown; there is a dense patch of yellowish-brown upright forked scales behind; verticals bristles golden, orbital dark brown.

Basal joint of antenna pale brown clad on the inner face with spatulate scales those above being pale olive-brown in colour, in some lights darker brown, those below creamy with a yellowish tinge, second joint with the basal half pale brown clad with creamy-yellow scales apical half dark purple-brown, remaining joints purple-brown with a pale ring at the insertion of the verticils; verticillate hairs dark brown. Clypeus dark purple-brown clad towards the apex with bluish-white narrow-curved scales. Palpi about half as long as the proboscis clad with purple-brown scales. Proboscis of moderate length clad as the palpi.

Thorax.—Prothoracic lobes more prominent than in other members of this genus covered for the most part with flat creamy scales in front, on the upper part behind the scales are dark brown. There is a tuft of large dark brown bristles on the upper angle in front. Mesonotum brown clad dorsally with a dense feltwork of long narrow-curved scales which are rich bronze under a hand lens but under a 1/2 are seen to be of mixture of dark brown and golden scales; round the margin of the anterior half is a well-marked band of pale golden scales which in front over the neck are narrow-curved but near the wings spatulate scales. Scutellum yellowish-brown clad with large spatulate scales dark purple on the lateral lobes, fawn-brown on the central lobe; bristles dark brown; number on central lobe variable, usually four. Pleurae brown with patches of creamy flat scales. Wings brown with dark brown scales purple when massed as on the costa; median scales rather long varying in shape on the different veins those on the anterior veins being about twice as long as broad while on the posterior veins they are broader in proportion to their length, some of them having oblique ends; lateral scales long and narrow; first fork cell longer and narrower than second, scarcely twice the length of its stem, its base about on a level with the base of the second though this is not so in every specimen; median and posterior cross veins of about equal length separated by more than twice their own length. Coxae muddy-yellow, fore and mid with both dark brown and creamy-white scales and pale brown bristles, hind with creamy-white scales and pale bristles; femora dark purple-brown silvery beneath and on the hind femora at the sides; tibiæ dark purple-brown with a narrow yellow apical ring; tarsi dark purple-brown; fore and mid ungues equal and uni-serrate, hind equal and simple.

Abdomen.—Dorsally clad with dark purple-brown scales and narrow creamy apical bands. Venter creamy. Lateral spots triangular with concave upper edge.

Occurrence.—Described from three females two of which were taken in the jungle at "The Gap" and one was bred from a larva in a bamboo in jungle on the Pahang Road five miles from Kuala Lumpur. The date of capture of first two was April that of the second June.

Remarks.—Like L. Annulitarsis this mosquito has its clypeus scaled but the scales are curved and narrow while on the clypeus of annulitarsis they are flat and elliptical. The two species cannot be confused as annulitarsis has the legs banded and not the abdomen while cingulata has unbanded legs and banded abdomen. I have a male and female in all respects resembling cingulata but without the scaling on the clypeus and I hesitate to make a separate species of this with so little material merely on

he ground of the absence of scales from the clypeus. Cingulata is evidently airly common in the jungle at "The Gap" though it only became trouble-ome in one place some 800 feet above the level of the road. It is a vicious iter like all members of this genus but apparently very local in its istribution.

Leicesteria Annulitarsis. n. sp.

Head elongated with a narrow white margin to the eyes dark brown cales above and a broad white band followed by a dark brown band at the ide. Palpi white tipped, half as long as the short thick proboscis. Thorax vith creamy margin in front and bronze scales on the dorsum. Abdomen lark brown above white and brown beneath. Legs brown with creamy nee spots and basal bands on the metatarsi and tarsal joints.

Female Head.—Much flattened laterally clad above with large spatulate cales of a dark purple or dark olive-brown according to the direction of the ight with a narrow line of white scales in the centre and a broad band of the same on either side succeeded by a band of dark brown scales; long the orbital margin of either side is a very narrow white line, and on he nape there are a few rows of light brown upright scales; vertical bris-les pale golden, orbital brown. Basal joint of antenna light brown with white spindle-shaped scales on the inner and lower faces, second joint pale at the base, dark brown at the apex and clad with large white spatulate scales on the inner face, remaining joints dark blackish-brown with white lowny hairs and dark brown verticils. Clypeus dark brown densely scaled with white elliptical scales. Palpi half as long as the proboscis clad with lark purple-brown scales except at the apex where the scales are snowy-white. Proboscis thick and rather short, scaled with dark purple-brown scales.

Thorax.—Prothoracic lobes small, clad with large flat scales white on he front, dark brown behind. Mesonotum with a broad marginal band round the anterior half of creamy scales (in some lights these scales are almost golden), in front over the neck these scales are narrow and curved out on the shoulders and in front of the wings they are broad spatulate scales; the rest of the mesonotum is densely covered with long narrow-curved bronzy scales. Scutellum yellowish-brown, central lobe with pale fawn-brown spatulate scales. Pleuræ brown, with numerous patches of snowy-white flat scales. Wings clad with dark brown scales with purple reflections; median scales long spatulate scales, lateral broadly linear scales; first fork cell longer but no narrower than the second, its stem about two-thirds the length of the cell, its base nearer wing base; posterior cross vein about twice its own length from the median. Fore and hind coxæ yellowish-brown, mid darker brown, all clad with snowy-white flat scales; femora dark brown above, snowy-white beneath, knee spots white; tibiæ dark brown with a narrow white ring at the apex best marked on the hind tibiæ; metatarsi of all legs clad with dark brown scales with purple reflections except at the base where there is a band of white scales; all tarsal joints dark brown with white basal bands on the first only in the fore leg, and on the first and second in the mid and hind legs.

Abdomen.—Dark purple-brown above, below the segments are scaled silvery-white except for a narrow dark brown band at the apex of each segment the scales on the last two apparent segments are in some specimens yellow. The lateral spots are triangular in shape the upper side of the triangle being concave. At the base of the last four or five segments there is a patch of yellow scales the lateral spots here being parti-coloured.

Male.—In the only specimen obtained the head is not so flattened from side to side the central white line is reduced to a white spot the basal joint of the antennæ is lighter in colour the antennæ are plumose with dark olive brown plumes. Palpi very slender longer than proboscis by about the last joint scaled dark purple-brown with a creamy ring at the base of the ultimate penultimate and the centre of the antepenultimate joints. The clypeus is scaled as in the female. Fore ungues markedly unequal the larger toothed at the base the smaller simple. Mid ungues equal and both uni-serrate. Hind equal and simple. Genitalia simple consisting of a rather long basal piece of equal breadth throughout and a long chitinous clasper shaped like the blade of a scythe. In all other respects the male resembles the female.

Occurrence.—Like other members of this genus this species appears to be entirely sylvan and is apparently very local in its distribution. It has only been found where other members of the genus are common. I have seen no specimens at "The Gap" though L. Dolicocephala was very common there. The only places I have taken it so far are jungle off the Pahang Road, Kuala Lumpur, and at Ulu Gombak. There is a stretch of jungle about five miles from Kuala Lumpur on the Pahang Road where members of this genus are exceedingly common during the months of October, November and December, and to be found at all times though not in such numbers. This species is not so common as the previous one but I have a series of females though only one male. It is a bamboo breeder but I have not recognized the larva. It is quite distinct from the other members of the genus the banded legs the white tipped palpi and in the male the banded palpi and the scaled clypeus all serving to distinguish it. The scaling of the clypeus though to be noticed does not I think warrant separating it from this genus which in all other points it so closely resembles.

Genus 9.—**Chaetomyia.**—NOV. GEN.

Head clad with large spatulate and upright scales the latter confined to the nape. Proboscis thick. Female palpi more than half the length of the proboscis, male palpi longer than the proboscis very slender and without hairs. Prothoracic lobes clad with large spatulate scales. Mesonotum with dense covering of hair-like scales with broad curved scales along the margin and on the shoulders. Scutellum with broad spatulate scales. Metanotum with scales and chaetae.

Remarks.—Founded on one species. It comes close to the genus Leicesteria resembling it in the scaling and the long female palpi, but differs in having scales and chaetae on the metanotum the only culicina that shews this character. It is purely sylvan and like Leicesteria breeds in water in bamboos. The head scaling is similar to that seen in Desvoidya

ıere being a patch of narrow-curved scales on the occiput and the rest of ıe head is covered with large spatulate scales and upright ones confined) the occiput, but the long female palpi while resembling those in Leicesəria distinguish this species from Desvoidya while the presence of chaetae nd scales on the mesonotum separate it at once from both the above-ıentioned genera.

Chaetomyia Flava. n. sp.

A large mosquito. Head clad with dark brown and pale golden patulate scales arranged in alternate bands and with creamy upright cales behind, and a patch of pale golden narrow-curved scales in the centre)f the occiput. Palpi rather more than half the length of the proboscis. Metanotum with chaetae and narrow scales. Mesonotum with dark bronze cales on the dorsum and a lateral band of pale golden scales round the nterior half. Abdomen with apical bands and large creamy-yellow lateral)ands.

Female Head.—Dark brown, clad with large spatulate and a few narrow-:urved scales arranged as follows:—a large central patch of pale golden ;cales, in the centre of which towards the vertex is a small patch of deep)rown scales and behind in the centre a patch of golden narrow-curved ;cales ; on either side of the central patch is a band of deep brown scales flanked by a band of golden scales and these are succeeded by a band of dark brown scales. The upright scales are pale flaxen and cover an area roughly circular occupying the centre but they do not extend forwards to the vertex. The area clad with golden scales above varies in different specimens. Basal joint of antenna honey-yellow with small pale yellow scales on its inner face, remaining joints deep purple with purple verticillate hairs. Palpi and proboscis clad with deep brown scales, the palpi being about half as long as the proboscis.

Thorax.—Prothoracic lobes clad with deep brown spatulate scales on the upper half behind and with creamy elliptical and linear scales below, the front being golden scaled. Mesonotum light brown, the dorsum clad with a dense feltwork of dark bronze scales while on the anterior margin is a band of pale golden scales. Pleurae light yellowish-brown with patches of creamy pale golden and dark brown scales which are of various shapes some being racquet-shaped, others narrow-curved, elliptical and spatulate. Wings with yellow veins clad with ligulate median and linear lateral scales; fork cells long, first longer and narrower than the second, its base nearer wing apex, its stem rather more than half the length of the cell ; posterior cross-vein rather more than its own length from the median. Coxæ pale yellowish-brown with creamy scales ; legs clad with deep brown scales except the ventral surfaces of femora which are golden-brown ; the apex of each tibia shews a creamy-yellow band and a similar band exists at the base on the metatarsus and first three tarsal joints of the hind leg. The metanotum is light golden-brown and shows a few narrow golden scales and bristles, the number of these varying in different specimens.

Abdomen.—Clad with deep brown scales above, the apex of segments two to five inclusive shewing a small band of yellow scales convex on the

proximal side, while laterally there is a large creamy triangular spot on all segments after the first the venter being entirely clad with creamy scales.

Male.—The male has plumose antennae and three-jointed palpi which are slender, about as long as the proboscis and are clad with dark brown scales with a creamy-yellow band in the middle of the antepenultimate joint and another at the base of the penultimate. In all other respects it resembles the female.

Occurrence.—Described from a series bred from larvae from water in a bamboo and in a cocoanut shell lying in the jungle.

Remarks.—An entirely sylvan species, and a vicious day biter. It is closely allied to Desvoidya and Leicesteria but is easily distinguished from all other members of the sub-family Culicina by the chætæ and scales on the metanotum.

Genus 10.—**Dasymyia.**—NOV. GEN.

Head with large spatulate scales and a few upright scales on the nape. Female palpi short, male very slender and scarcely half the length of the proboscis. Proboscis enlarged apically. Mesonotum with narrow-curved scales and enormously long bristles. Scutellum with spatulate scales only. Wings with very broad asymmetrical lateral scales and piriform median scales.

Remarks.—Only one species of this genus is known but its characters are well defined. The broad wing scales remind one of those on the wing of Mansonia while the head and scutellar scaling is that of a stegomyia, but the enormously long mesonotal bristles is a character quite its own. The species were all taken in jungle, one at Bukit Kutu and the others hovering round a small pool in the jungle at Ulu Gombak. There is no mosquito this species could possibly be mistaken for. I have placed the genus here for convenience but am not sure that its affinities are not more with members of the sub-family Aedeomyina. The genus Mimomyia which Mr. THEOBALD places in the Aedeomyina has identically the same proboscis and palpi but species of Mimomyia have short fork cells, curiously shaped mesonotal scales and narrow-curved scutellar scales whereas species of Dasymia have long fork cells clad with large asymmetrical scales, spatulate scutellar scales and ordinary narrow-curved mesonotal scales with unusually long bristles.

DASYMYIA FUSCA. N. SP.

Head covered with broad spatulate purple scales with a white patch on the vertex and silvery lines along the orbital margins and a few rows of dark brown upright scales on the nape with broad serrated ends; orbital and vertical bristles dark brown. Wings covered with broad asymmetrical scales. Thorax unusually hairy. Legs without spots or bands. Abdomen purple-black with ochraceous hairs on the borders of the segments and basal ventral bands.

Female Head.—Clad with broad purple-black spatulate scales with rounded ends, a small patch of white scales on the vertex and a line of silvery scales along either orbital margin, and on the nape a few rows of dark brown upright scales with broad serrated ends; orbital and vertical bristles long and dark brown. Basal joint of antenna almost black with broad silvery-white scales on the inner face, second joint pale at the base black at the apex with a ring of small black scales inserted about half-way up the joint just below the verticillate hairs, remaining joints dusky black with numerous short black hairs on the basal two or three joints and white on the others; verticillate hairs dark blackish-brown. Clypeus black and nude. Palpi long, rather less than one-third the length of the proboscis, covered with blackish-brown scales and a few long hairs. Number of joints cannot be determined. Proboscis of moderate length, with the apical fourth enlarged, the whole covered with black scales with purple reflections; labellæ pale yellowish-white.

Thorax.—Prothoracic lobes dark brown apparently without scales but with a row of long dark brown bristles, not very plainly seen in the specimen. Mesonotum dark purple-brown clad with narrow-curved dark purple-brown scales and numerous very long bristles. There are two central rows dark purple-brown in front but lighter brown on the posterior half, a tuft on either shoulder and a marginal row passing over the wing bases where they are of great length. Immediately over the wing base the mesonotum is of a light yellow-brown. Scutellum paler than mesonotum densely clad with small spatulate scales of a purple-brown colour. The basal scales are shorter and have more rounded ends than those at the apex. Central bristles denuded five in number, all the bristles dark brown in colour. Pleuræ dark brown with yellowish-brown lines at the junctions of the various pieces, with a large central patch of broad racquet-shaped silvery-white scales and other smaller patches in part denuded. Wings rather narrow densely scaled, with spinose dark brown scales on the anterior edge of costa, a row of dark brown broad asymmetrical scales on the subcosta, two rows of scales on the first long vein placed as laterals and not median, which at the base are large and asymmetrical but towards the apex become smaller and elliptical; second long vein carried beyond the marginal transverse clad with large broad scales many of which are asymmetrical others elliptical, third long vein with a single row of broad median scales notched at their ends and a few broadly elliptical lateral scales, fourth and fifth clad as the third, lower branch of fifth and the whole of the sixth with large broad notched median scales and no laterals those on the sixth being larger and broader than the median on the fifth; all the scales are unusally large. Some of the asymmetrical are quite like those on a Mansonia wing notably the terminal scales on the sixth vein. The notching is very marked on the median scales of the sixth. I have at present seen no wing that would compare with this one except perhaps among the Uranotæniæ or members of the genus Etorleptiomyia. Supernumerary cross-vein very oblique, posterior transverse nearly three times its length from median; fork cells of about equal breadth, first longer than second, its base nearer wing base; fringe scales long, border scales spatulate. Coxæ light yellowish-brown clad with pearly-white flat scales; thighs clad with dark purple-brown

scales above creamy below for a variable distance, the part so scaled on the hind thigh being greater than that on the fore; at the apex of each femur there is a narrow pale ring; tibiæ purple scaled with a pale ring at the apex of each; fore and mid metatarsi and tarsi purple-brown scaled; last two tarsal joints of hind leg pale fawn-brown almost creamy; fore and mid ungues small equal and apparently simple, hind similar but smaller.

Abdomen.—Clad above with purple-brown scales the metallic-purple tint being very evident. There are small basal white lateral spots evident on some of the segments. On those segments which do not shew this I am convinced it is because they have telescoped beneath the preceding segment owing to the shrinking due to drying. Numerous ochraceous hairs are inserted on the free edge of each dorsal sclerite. Ventrally each segment is scaled with pale ochre-yellow scales on its basal two-thirds and purple-brown on its apex.

Male.—Head scaled as in the female but the scales at the side are rather paler in good light having a light silvery-brown colour. Antennæ markedly plumose, with black basal joint (difficult to see in the particular specimen as the joints have become partially concealed by the falling in of the frons from drying) with pearly-white scales, the remaining joints being black with a white band at the base. Plumes long, dark purple-brown, paler towards the apex. Palpi about three-fourths the length of the proboscis very slender and absolutely free from hairs, but clad with purple-brown scales. Number of joints indeterminate. Apical third of proboscis considerably enlarged, the whole with scales similar to those on the palpi. Wings with the same broad notched scales as in the female; fork cells of nearly equal breadth, first longer than second, bases level; lateral scales on veins fewer than in the female. Legs scaled precisely as in the female with the same pale fawn scales on the hind tarsal joints. Fore ungues markedly unequal larger unguis uni-serrate, smaller simple; middle ungues unequal but less so than the fore, large tooth uni-serrate; hind ungues equal and simple. Genitalia apparently remarkably simple covered with ochraceous hairs. Abdomen otherwise as in the female.

Occurrence.—One male taken in the jungle five miles from Kuala Lumpur and one female taken in the bungalow at Bukit Kutu.

Remarks.—A new genus had to be created for this mosquito as it differs so markedly from Stegomyia and Scutomyia. The head scales are more rounded at the end, the female palpi are longer and the male shorter than in Stegomyia. The wing scales are unique and somewhat resemble those on the wing of a Mansonia and the length of the hairs on the mesonotum is greater than any mosquito I have seen out here. If it were not for the male palpi I should certainly have placed this mosquito near the genus Uranotænia as its affinities are much nearer that genus than Stegomyia. The new genus Etorleptiomyia created by Mr. Theobald for specimens described in "First Report of the Wellcome Research Laboratories, Khartoum, 1904," and of which I have described one species in this work has wing scales somewhat similar, and the proboscis and palpi in this species exactly

esemble those illustrated as belonging to a male Mimomyia which latter enus Mr. THEOBALD places in the sub-family Aedeomyina while the ring scales of Mimomyia resembles those seen in members of my genus onopomyia. Altogether I prefer to retain Dasymyia in the sub-family ulicina as the male palpi are much longer than those seen in any member f the sub-family Aedeomyina.

Genus 11.—**Phagomyia.**—*Theobald.*

This Genus is unrepresented in Malaya.

Genus 12.—**Catageiomyia.**—*Theobald.*

Only one species of this is at present known from West Africa. It pparently does not occur here.

Genus 13.—**Polyleptiomyia.**—*Theobald.*

This Genus is unrepresented here.

Genus 14.—**Scutomyia.**—*Theobald.*

Head covered with large spatulate scales except on the vertex where here are narrow-curved scales. Scutellum with racquet-shaped scales. Prothoracic lobes with narrow-curved scales above and spatulate ones below. Proboscis long and slender. Male palpi shorter than the proboscis.

Remarks.—Founded on one species fairly common in jungle here. It s a slender mosquito and differs from Stegomyia in having narrow-curved scales on the head and similar scales on the prothoracic lobes whereas in Stegomyia there are only flat scales on the head and prothoracic lobes. Another point of difference is the absence of any broad scales on the shoulders and the scales on the scutellum differ from those on the scutellum of Stegomyia.

SCUTOMYIA ALBOLINEATA.—*Theobald.*

A small black and white mosquito with a conspicuous white central band running nearly the whole length of the thorax and pearly-white lateral spots to the abdomen. At first sight one might mistake this mosquito for Stegomyia scutellaris but the hind legs have only two bands and not four as has scutellaris.

Female Head.—Black, in front between the eyes there is a triangular tuft of long white narrow scales, behind this there is a patch of bluish-white broad scales extending back to the nape. Except for a few wihite scales at the side arranged as a narrow band the rest of the head is clad with broad black scales. Round the occipital foramen there are a few rows of black upright forked scales. Vertical bristles black, orbital black with pale tips. Basal joint of antenna black with its inner face thickly clad with small broad white scales and a few black ones at the immediate base, remaining joints black, pale at the insertion of the verticils, with a few black scales on the second joint, and numerous short silky white hairs

on all the joints after the second. Last joints not elongated. Palpi rathe short, black scaled ; joints concealed. Proboscis long and slender, blac scaled.

Thorax.—Prothoracic lobes very prominent, black, clad above and i front with narrow-curved scales, behind with broad dusky black scales Mesonotum black, densely clad with long narrow-curved black scales; broad line of bluish-white narrow scales runs down the centre for about two thirds the length of the mesonotum. In front of each lobe of the scutellum there is a bare space. Mesonotal bristles black. Scutellum black, centra lobe clad for the most part with broad bluish-white racquet-shaped scales; at the apex there are two rows of dark scales shewing metallic tints. O either side is a bare space, then a tuft of broad black scales on eithe lateral lobe. Scutellar bristles black. There are four central and six lateral. Pleura black or very dark brown with a broad line of white scale crossing it transversely and a patch of white scales above the mid coxa Wings clad with black scales ; a double row of median scales on all vein to the fourth inclusive; the lateral scales of first fork cell rather broad ; al the scales with square ends ; first fork cell about the same length as its stem a little longer and narrower than the second, its base nearer wing base, supernumerary and median cross veins meeting at an angle, of abou equal length, posterior cross vein about twice its length from the median. Coxae dark brown ; fore coxae clad with broad white scales in front and several bristles on their apices projecting downwards and forwards. There is a small patch of white scales on the middle coxa and a band of white scales running down the outer side of the hind coxa. Fore legs are entirely scaled with purple-black scales except for a thin line on the under surface of the femora, mid legs white scaled on the under surface of the femora and they have a patch of white scales at the apices, the rest of the leg is black scaled. In the *hind legs* the femora are entirely white scaled except for a short distance above where there is a line of dark scales which just before the apex expands on to the sides, the immediate apex is white scaled ; the metatarsus and first tarsal joint are basally banded white the former broadly so, and there is a small patch of white scales at the base of the second tarsal joint. Ungues equal and simple on all the legs.

Abdomen.—Dorsum purple-black scaled. On the venter at the base of the segments there is a broad band of pearly-white scales, and laterally there are triangular spots of pearly-white scales. On the penultimate segments the lateral spots extend dorsally and form more or less complete basal bands.

Male Head.—A bare line down the centre which does not shew in the female. Scaling as in the female. Last two joints of antenna elongated, remaining joints very short ; verticillate hairs black. Palpi not more than half the length of the proboscis, entirely black scaled, very slender and except for a terminal spine almost destitute of hairs. They look five-jointed but without dissection it is impossible to tell. Proboscis long.

Thorax.—In all respects similar to the female. The fork cells of the wings are remarkably short, of almost equal length not more than about half as long as their stems, there is only a single row of median scales and very

ew laterals. The border scales are very long. Legs as in the female; fore ingues are almost equal and there is a small basal tooth on the larger ; mid ingues unequal and apparently without teeth.

Abdomen.—As in the female.

Remarks.—In the tuft of narrow spindle-shaped scales on the vertex he shape of the body and the shortness of the male palpi this mosquito liffers from members of the genus Stegomyia. There is a peculiar upturn-ng of the end of the abdomen which is seen in Wyeomyia.

Genus 15.—**Hulecoeteomyia.**—*Theobald.*

Head with narrow-curved scales along the eyes, in the centre, and oosely scattered over the nape, spatulate scales at the sides and numerous upright scales inserted over the whole surface. Thorax with narrow-curved scales. Scutellum with a central line of narrow-curved scales and narrow-curved scales on the lateral lobes and small spatulate scales on either side of the central line on the middle lobe. Wings with broadly linear scales. Male palpi shorter than the proboscis.

Remarks.—Three species of this genus are at present known and they all resemble one another very closely. The genus is evidently closely related to Macleaya but the central line of narrow curved scales among the broad scales on the scutellum is quite a distinct feature. The head is scaled something like a Culex but the broad scales come nearer the middle line and the narrow-curved scales are not as numerous as in that genus. They are all sylvan species and breed in bamboos except H. Fluviatilis which breeds in rock pools in the course of jungle streams. They are vicious day biters.

Hulecoeteomyia Trilineata.—*Theobald.*

Head with snowy-white narrow-curved scales along the upper part of the orbital margin of either side and similar scales on the vertex and running back to the occiput as a central white line where it spreads out into a triangular patch. On either side of the central line is a large patch of dark umber-brown spatulate scales and outside these a band of white scales, then a band of dark brown followed by white. Palpi white tipped; proboscis generally banded. Thorax with seven pale golden lines the central one forked at the base of the scutellum. Metatarsi and first two tarsal joints of all legs with creamy basal bands. Abdomen with large white lateral spots and white ventral bands.

Female Head.—Black, with a line of silvery-white or in some specimens golden-yellow rather broad curved scales running down the centre and on the nape are scattered white narrow-curved scales forming a triangular patch; similar scales form a narrow silvery line along the upper half of the orbital margin. On either side of the central line is a patch of spatulate scales black in the fresh specimen dark umber-brown in the dry and outside this is a band of silvery-white scales, then a band of dark, then white scales. Vertical bristles golden, orbital dark brown. Basal joint of antenna brown, dusky on the inner face where it is clad with dark brown flat scales, second joint pale at its base dark brown at the apex clad with black scales, remaining

joints dark brown with silvery down and dark brown verticils. Clypeu dark chestnut-brown. Palpi yellowish-brown, four-jointed, first join constricted in the middle, fourth joint very small, clothed with black spatu late scales except towards the tip which is white scaled. The amount o this white scaling varies, in one specimen it includes little more than th last joint, in another one it includes half the penultimate joint. Proboscis yellowish-brown, black scaled dorsally and laterally, white beneath About half-way white scales appear laterally and may even go right round forming a complete band. In some specimens there is no band on the proboscis.

Thorax.—Prothoracic lobes brown, prominent, white scaled. Meso- notum dark brown clothed with narrow-curved scales dark bronze-brown under a hand lens but under 2/3 the tips show pale golden. There is a central line of pale golden scales which forks in front of the scutellum enclosing an unscaled area, on either side in front there is another line which runs back about one-third the total distance and placed a little further out behind on either side is another line running forwards from the scutellum and ending just a little to one side of the anterior lateral line, and another golden line over the root of each wing and on the anterior margin just above the prothoracic lobes are scattered white scales. There are numerous black bristles arranged in lines. The scutellum is fawny-brown; on the central lobe there is a patch of black short clavate scales arranged in a rosette with a central line of creamy-white scales which are narrow-curved scales at the apex of scutellum; the lateral lobes have a few black narrow curved scales. The scutellum is not heavily scaled and the scales are quite unlike those of an ordinary Stegomyia there are four to six bristles on the central lobe two of which are pale golden four black. Pleurae dark brown with patches of broad white scales. Wings clad with black scales, median rather long and narrow spatulate, lateral lanceolate. At the base of the costa is a patch of white scales. Fork cells of moderate length, first sub-marginal longer and narrower than second posterior, its base nearer wing base, cell longer than its stem; supernumerary and mid cross veins meeting at an angle, posterior cross vein twice its own length from mid cross vein. Coxae creamy-yellow; femora of fore and mid legs black scaled dorsally and laterally, white scaled beneath, with a ring of golden-brown spines around apex; tibiae same as femora minus the spines except that the extreme apex is clothed with a few creamy-yellow scales; metatarsus and first tarsal joint basally banded creamy-yellow, the remainder scaled black. Ungues equal and uni-serrate; hind .femora scaled as the others except the middle third of the anterior and posterior surfaces which is creamy; knee spot creamy; tibia entirely black scaled with four lines of short white spines running down its whole length; metatarsus basally banded, first two tarsal joints very broadly basally banded with creamy scales. Ungues equal and simple. Metanotum dark chestnut-brown. Halteres with black scaled stems and white scaled knobs.

Abdomen.—Black scaled, except for a few white scales at the bases of the segments after the second (which scarcely amounts to basal banding) in some specimens, and laterally there are triangular patches of white scales and ventrally the segments are basally banded white.

Male Head.—Scaled as in the female. The antennae have pale internodes and dark nodes, and the two last joints are very long; verticillate hairs long and black. Palpi about four-fifths the length of the proboscis, dirty white and clad with black scales. A naked area in the middle of second joint shows white under a lens. White scales which may or may not form a complete band at the apex of second and third joints. These scales may involve both sides of the joint. They are variable. Proboscis long, black scaled with a narrow band of white scales about its centre. The thoracic scaling is the same as in the female and the leg scaling also. Wing scaling similar but not so heavy. Abdominal banding more marked all the segments showing fairly broad basal white bands and large lateral spots. The penultimate segment has a dorsal patch of white scales with a pearly lustre. The fore and mid ungues large unequal larger unguis biserrate.

Occurrence.—This mosquito is a very distinct species. It is a bamboo breeder the other species is rarer and apparently only breeds in rock pools supplied by a river. It is by no means a common mosquito is entirely sylvan and a blood sucker. It has been caught at Bukit Kutu and in jungle on the Pahang Road five miles from Kuala Lumpur and at Ulu Gombak thirteen miles from Kuala Lumpur but as it is a bamboo breeder it is probably to be found wherever bamboo is plentiful. The band on the proboscis is very variable and in some specimens it is entirely absent in others only marked on the under side.

Time of capture at Bukit Kutu in May and in the neighbourhood of Kuala Lumpur April, May, July, October and December.

Helecocteomyia Jugraensis. n. sp.

Head with golden orbital margins and creamy central line with blackish-brown patches on either side of this with a band of white scales low down laterally. Thorax with variable ornamentation but as a rule with one central golden unforked and a short line on either side of the posterior half of the mesonotum. Pearly lateral spots on the last four abdominal segments.

Female Head.—Black. Viewed from above there is seen a central line of creamy narrow-curved scales with similar scales scattered irregularly over the nape, a row of pale golden scales along the orbital margin of either side and dark patches of spatulate blackish-brown scales over the rest of the head with numerous rows of black upright scales inserted as far forwards as the vertex. If the head is viewed from the side a lateral band of white scales can be seen but this is too low down to be seen when looking down upon the upper surface. Vertical bristles creamy-yellow. Clypeus deep brown. Palpi about one fifth the length of the proboscis clad with black scales and in some specimens shewing two or three white scales at the tip. Proboscis long, longer than the abdomen, clad with black scales.

Thorax.—Prothoracic lobes black clad with small elliptical silvery scales. Mesonotum deep chestnut-brown entirely covered with blackish-

brown narrow-curved scales and ornamented as follows—a central line of golden scales which runs on to a well marked bare space in front of the middle lobe of the scutellum but does not run to the end of it and this line never forks; on either side on the posterior half of mesonotum is another well marked line of golden scales and there is a short line over the roots of the wings and scattered golden scales along the anterior margin and on the shoulders. In some specimens there is a hint of the anterior lateral golden line seen in H. Trilineata but it consists as a rule of a scattered golden scale here and there and never a continuous line. Scutellum brown. Central lobe with a line of golden narrow-curved scales in the centre and small black spatulate scales on either side of this, lateral lobes with black narrow-curved scales. Bristles of central lobe pale golden in the centre and dark brown on either side. Pleurae dark brown with patches of silvery racquet-shaped scales. Wings with dark brown scales the lateral scales broadly linear though towards the apex of the wing they are slightly clavate; fork cells long, first longer than second, its base nearer wing base, its stem not half the length of the cell; posterior cross-vein but little more than its own length from the median. Coxæ creamy-white; femora clad with black scales a small patch of creamy scales on the upper surface of apex of fore femora and an oval silvery patch on the posterior surface of hind femora near its middle; metatarsi and first tarsal joints of fore and mid legs with narrow creamy basal bands, a broad creamy band at the base of metatarsus of hind legs and a broad white band at the base of the first and the second tarsal joints; fore and mid ungues equal and uni-serrate.

Abdomen.—Clad with black scales with pearly lateral spots and creamy basal white bands on the venter.

Male.—Antennae plumose with coal-black plumes. Proboscis long and with a ridge about its middle suggesting a joint. Palpi not more than three-quarters the length of the proboscis, slender clad with black scales with a white patch on the under surface of the base of the ultimate joint and golden spines at its apex. Rows of golden spines on all the femora. Fore and mid ungues very large unequal and each unguis bears a tooth. Lateral abdominal spots extend more on to the dorsum than in the female and nearly form complete bands.

Occurrence.—Described from a series bred from larvae taken from water collected in fallen leaves in the jungle at Jugra.

Remarks.—Though closely resembling H. Trilineata a careful comparision shows sufficient differences to warrant the separation of the two. The central golden line on the mesonotum in H. Trilineata invariably forks and the two arms of the fork enclose the bare space in front of scutellum; in this mosquito it never forks but runs over part of the bare space. The two anterior lateral lines conspicuous in H. Trilineata are either entirely absent in this species or represented by merely a scattered scale or two. The specimens are very perfect so that this is not due to denudation. The proboscis in Trilineata is always more or less banded and the palpi with well marked snowy tips, in Jugraensis the proboscis is never banded and the palpi shew but one or two pale scales at the tips. The

asal bands on the hind leg are much broader in Trilineata than in ugraensis. Finally the larvae are very markedly different. The name rilineata is an unfortunate one as there are really seven distinct lines on I. Trilineata whereas in H. Jugraensis there are only three, but the names nust stand as H. Trilineata was named before the discovery of H. ugraensis.

Hulecoeteomyia Fluviatilis. n. sp.

A large triangular patch of golden narrow-curved scales on the upper urface of the head the apex of the triangle reaching to the vertex, a narrow nargin of similar scales along the upper half of the orbit the rest of the ıpper surface clad with dark brown almost black spatulate scales, vhile laterally there is a patch of creamy-white spatulate scales; dark umber-ɔrown upright forked scales are inserted as far forward as the orbital nargins. Mesonotum with seven lines of golden scales and dark bronze-ɔrown scales between. Metatarsi and first two tarsal joints of all legs ɔanded with creamy scales. Proboscis and palpi scaled dark brown with a few white scales on the tips of the palps in some specimens.

Female Head.—Purple-black; upper part clad with narrow curved scales of different colours arranged as follows a narrow line along the upper half of the orbital margin of each side deep gold in colour, a broad central line running backwards to the occipital foramen composed of scales which in some lights are almost white in others pale golden but in a fresh specimen are distinctly golden numerous golden scales loosely scattered over the nape and dark brown spatulate scales forming an eye-like spot on each side behind the golden scales of the orbital margin, and beyond these there is a large patch of creamy small spatulate scales. Numerous dark brown upright forked scales are inserted on the occiput and as far forwards as the orbital margins. A tuft of pale golden vertical bristles project between the eyes; orbital bristles dark brown. Basal joint of antenna light brown darker brown on the inner face which is clad with small dark brown scales, base of second joint light brown upper half dark brown with blackish-brown scales, remaining joints dark brown with silvery short hairs and dark brown verticillate hairs. Clypeus purple-brown. Palps dark brown with dark blackish-brown scales and some white scales at the tips, in length rather less than one-third the length of the proboscis. Proboscis scaled as the palpi.

Thorax.—Prothoracic lobes dark purple with a band of creamy flat scales running obliquely from the upper part in front downwards and backwards; part of the lobe is bare. Mesonotum chestnut-brown clad with dark brown narrow-curved scales and ornamented with seven lines of golden narrow-curved scales, a central line down the whole length forking in front of the scutellum, a lateral line on either side in front ending a little in front of a line joining the wing bases, and a similar line on each side placed just external to this which runs backwards to base of lateral lobe of scutellum and a line over the roots of the wings, while round the margin in front is a band of golden scales. Mesonotal bristles dark brown. Scutellum light brown; on the middle lobe is a central line of golden narrow-curved scales flanked on either side by dark blackish-brown spatulate scales, the lateral

lobes are clad with dark brown narrow-curved scales; central bristles five or six in number. Pleurae brown with seven patches of white spatulate scales. Wings heavily clad with dark brown scales the median being long and narrow the lateral broadly linear; fork cells of about equal breadth the first longer than the second, its base a little nearer the apex of wing, its stem nearly as long as the cell; posterior cross-vein rather more than its own length from the median. Coxæ brown with silvery scales, fore coxæ with dark brown scales in front; bases of femora ochraceous, remainder of fore and mid femora dark brown scaled except on the under surface which is silvery, hind femora ochraceous at the base with a broad silvery band nearer the base than the apex in breadth about equal to a third of the total length of the femur and broader below than above; knee spots creamy-yellow; tibiae dark brown; metatarsi and tarsi of all legs clad with dark brown scales. On the fore and mid legs there is a creamy basal band on the metatarsi and first tarsal joint, on the hind leg there is a creamy basal band on the metatarsus and first two tarsal joints that on the second tarsal joint being very broad occupying the basal half of the joint.

Abdomen.—Covered dorsally with dark brown scales, while on the venter there is a band of snowy-white scales at the base of each segment, and laterally there is a glistening pearly-white spot at the base of each segment on either side.

Male.—Antennæ with light brown joints and deep brown plumes. Palpi a little shorter than proboscis, very slender, clad with black scales with the suggestion of a pale band at the base of the ultimate joint and some long golden spines at bases of ultimate and penultimate joints. Fore and mid ungues unequal and each unguis on both legs has a tooth. Genitalia with slender lobes clad with black scales and a few golden spines and each bears a golden simple clasper at its apex.

Occurrence.—This mosquito though resembling the previous species is quite distinct. The following points serve to distinguish it from trilineata, there is no band on the proboscis, the white tip on each palp is less marked the yellow lines on the mesonotum are deeper in colour than in trilineata, and it is a larger mosquito. The larvæ are quite distinct and found in rock pools and not in bamboo. As I have never taken the imago of this mosquito I do not know anything of its habits. It is evidently rare as so far it has only been found in one place namely Ulu Gombak jungle.

Genus 16.—**Macleaya.**—*Theobald.*

Only one species of this genus is known and it is an Australian species. It comes very close to the preceding genus.

Genus 17.—**Howardina.**—*Theobald.*

This genus is apparently unrepresented here. In Vol. III. "Monograph of Culicidæ," Theobald, a genus with this name is placed in the Aedeomyinæ. But Mr. Theobald had not then received any males and he has since received such and has transferred the genus.

Genus 18.—**Acartomyia.**—*Theobald.*

Apparently unrepresented here.

Genus 19.—**Conopomyia.**—NOV. GEN.

Head entirely covered with spatulate scales with truncated ends nd upright scales confined to the nape. Antennæ very long the second joint ; of unusual length in some species as long as any three succeeding joints. Basal joint pyramidal. Palpi of female apparently two jointed. Male palpi two jointed as long as the proboscis and markedly clavate. Scutellum nd mesonotum clad with narrow-curved scales those in the centre f the mesonotum hair-like. Wings without lateral scales or with a few at he apex of the wing and these in most species are very broad and have the nds notched.

Remarks.—This genus is founded on three species. The larva of Conopomyia Metallica is found in the water at the marshy edges of onds or in meadows and is a very distinct and easily recognized larva aving a bright orange coloured body and a large black head and thick espiratory tube. The head bears six compound frontal hairs very long and ach hair is bi-pinnate. The pupa is even more distinctive than the larva aving two greatly elongated respiratory tubes which project forwards in he horizontal plane in front of the head. There is no other pupa I am cquainted with at all resembling this one. In the shape of the male palpi his genus resembles members of the genus Acartomyia but the cephalic caling in that genus is composed of a few narrow curved and loosely arranged patulate scales while in Conopomyia it consists of spatulate scales only set n imbricate rows. In colouring the species resemble members of the enus Tæniorhyncus while the long second antennal joint is seen in pecies of only one other genus, viz., Deinocerites. Altogether it is a little ifficult to say what its position is in the family Culicidæ. It is even difficult o say which sub-family it should be placed in. At first sight it appears to elong to the sub-family Culicina on account of the long male palpi but vhen examined more closely these palpi are found to consist of only two oints a character found only in members of the sub-family Aedeomyinæ. Members of the genus Mimomyia sub-family Aedeomyina have many oints in common with members of this genus, such as the cephalic and cutellar scaling the short fork cells and the scaling of the wing but in Mimomyia the male palpi are not nearly as long as the proboscis and are ot clavate, the second joint of the antenna is not especially long as it is in Conopomyia and the scales of the mesonotum in Mimomyia are long scales vith abruptly truncated ends while in Conopomyia they are the ordinary arrow curved and hair-like scales.

CONOPOMYIA METALLICA. N. SP.

Head clad with elongated spatulate scales with concave ends set in mbricate rows like tiles on a roof. These scales vary in colour according o the direction of the light on them from pale golden to peacock or azure-lue or peacock-green. Thorax with long curved black scales and golden nargins. Scutellum with black narrow-curved scales; pleuræ ochraceous. Legs banded with gold; last tarsal joint of hind leg all golden. Abdomen vith a central golden line.

Female Head.—Deep purple, clad with broad scales elongated spatulate with concave ends. These scales shew interruption colours in a fresh specimen and may appear deep gold or rose-purple, in a dry specimen they fade and become pale gold or in some lights azure-blue or peacock-green. There are a few black upright scales on the nape. Basal joint of antenna pyramidal in shape blackish-brown and with a few scales on the inner face. Antennæ unusually long, second joint as long as any two succeeding joints. Remaining joints deep purple with dark brown verticillate hairs. Palpi clad with golden scales at the base and black at the apex. Proboscis clad with dark purple scales above, golden below.

Thorax.—Prothoracic lobes blackish-brown in some specimens, light brown in others, clad with long bristles only. Mesonotum deep purple-brown in some specimens in other light brown with deep purple lines and patches clad with black narrow-curved scales and bright golden scales and bristles on either lateral margin. Scutellum deep brown with black narrow-curved scales. Pleuræ bright ochraceous or light yellowish-brown. Wings clad with dark purple scales, the median scales on the first long vein consist of a double row of rather broad short oblique-ended scales; on all the other veins there is a single row of median scales and on the branches of the fork cells and the extreme apex of the third long vein there are a few short broad fan-shaped lateral scales; fork cells very short of about equal length, the first narrower than the second, its base nearer the wing apex, its stem nearly twice as long as the cell; posterior cross vein less than half its own length from the median. Coxæ and bases of femora ochraceous; fore and mid femora ochraceous at the base and beneath; purple above; tibia clad with purple scales, the hind tibia with a broad pale golden band at the apex; metatarsus and first two tarsals joints on fore and mid legs purple scaled with a narrow apical band of pale golden scales on each, hind metatarsus and first three tarsal joints with narrow golden band, last joint entirely clad with golden scales much brighter in a fresh specimen than in the dry. Ungues equal and simple.

Abdomen.—First segment dark purple in the centre and ochraceous at the sides. A central longitudinal golden line runs the whole length of the abdomen from the second segment the rest of the dorsum being clad with bright purple scales. The venter is golden but when dry becomes golden-brown.

Male.—In a typical specimen the antennæ are densely plumose the plumes being bright flaxen but in others they appear more of a steel-grey. The proboscis is very long and clad with golden scales with a black band at the apex. The palpi are as long as the proboscis and apparently consist of only two joints the ultimate joint being clavate with black scales at its apex, golden-brown at its base, penultimate joint bright golden with a black band at its base in its centre and at its apex. Fore and mid ungues unequal the larger unguis with one tooth.

Occurrence.—Described from a series bred from larvæ taken in marshy ground round Kuala Lumpur and elsewhere.

Remarks.—A very distinct mosquito the swollen clubbed male palpi the peculiar shape of the head scales and the long antennæ being all points peculiar to members of this genus. The three species known are very similar in colouration.

Conopomyia Hybrida. n. sp.

Head black entirely covered with pale olive-brown spatulate scales and a few black upright ones confined to the nape. Thorax black with pale yellow narrow-curved scales on the anterior margin and in front of the scutellum and blackish-brown scales elsewhere. Abdomen deep purple with ochraceous basal bands. Legs unbanded.

Female Head.—Black completely clothed with pale copper coloured or olive-brown spatulate scales. On the nape are a few black upright scales with serrated free ends. Basal joint of antenna black with a few hairs on the inner face, second joint dusky-brown with a few black scales near its base as long as any two succeeding joints, remaining joints purple-brown with dark verticils. Palpi and proboscis clad with black scales.

Thorax.—Prothoracic lobes with black spatulate scales. Mesonotum deep purple-brown in front paler brown behind, clad with blackish-brown scales on the anterior margin and in front of the scutellum. Scutellum black with pale yellow narrow-curved scales on the middle lobe and black ones on the lateral lobes. Pleuræ colourless and translucent and without scales. Wings with black scales. The scales are broad spatulate and only median scales are present; fork cells very short about equal in length, the base of the second nearest the wing base the stem of the first nearly twice as long as the cell; posterior cross-vein less than its own length from the median.

Coxæ creamy; fore femora creamy with a few dark purple-brown scales above near the apex and a patch of creamy scales at the apex, hind femora creamy below, deep brown above. Tibiæ ochraceous at the apices; tarsi deep purple-brown. Ungues equal and simple.

Abdomen.—Deep purple with ochraceous basal bands; above these bands broaden out laterally. Venter indistinguishable owing to retraction.

Male Head.—Completely covered with broad spatulate scales in imbricate rows. When fresh these scales are of a bronzy-purple but dry they fade to a dingy white or ochraceous. On the nape there are a few rows of black upright scales. Basal joint of antenna deep brown, second joint light brown with a ring of dark brown scales, remaining joints light brown with dark brown rings at the insertions of the verticils. Plumes pale ochraceous with black tips. Palpi as long as the proboscis with greatly enlarged ultimate joint which is clad with purple scales and dark brown spines, penultimate joint long and slender enlarged at its apex which is clad with dark purple scales and a ring of dingy white scales in the centre.

Thorax.—Prothoracic lobes dark brown with dark brown bristles. Mesonotum brown with dark purple patches clad with golden-brown or bronzy narrow-curved scales. Scutellum dark brown with creamy narrow-curved scales. Pleuræ pale ochraceous. Wings with broad spatulate lateral scales and very short fork cells. Owing to position of wing a distinct view cannot be obtained. Posterior cross-vein a little less than its own length from median. Coxæ and bases of femora ochraceous. All legs clad with purple-brown scales without bands. Fore and mid ungues unequal larger unguis in each uni-serrate.

Abdomen.—With dark purple-brown scales above each segment with a narrow basal band of dingy white scales. Venter dingy white.

Occurrence.—Described from a series one male taken in my bungalow Kuala Lumpur and other males and one female sent me by Dr. Finlayson of Singapore.

Remarks.—This species is easily distinguished from the other members of the genus, and is apparently much more rare.

[Conopomyia Aurea. n. sp.]

Head golden-brown with golden-yellow spatulate, and dark brown upright scales. Proboscis clad with deep golden-yellow scales with a few scattered black scales on its upper surface which at the apex form a narrow band and include some dark brown narrow-curved scales. Scutellum brown with black narrow-curved scales. Wings with broad cordate lateral scales. Abdomen purple and gold. Legs banded.

Female Head.—Golden-brown, entirely covered with square ended spatulate scales deep golden-yellow in most lights (but shewing interruption colours) and darker brown upright scales confined to the nape. Basal joint of antenna pyramidal in shape golden-brown in colour with dark brown scales on the inner side, second joint of an extraordinary length as long as any three succeeding joints dark brown with small dark brown scales, remaining joints dark brown with dark brown verticillate hairs. Clypeus deep golden-yellow. Palpi longer than usual fully one-third the length of a rather long proboscis composed of only two joints (there may be a small basal joint but I do not think there is) the ultimate joint very long clad with deep golden-yellow scales and a patch of purple scales on the upper surface at its base, penultimate joint with golden-yellow scales. Proboscis very long, curved, clad with deep golden-yellow scales except the apical sixth which is clad with purple scales on its upper surface.

Thorax.—Prothoracic lobes golden-brown with bristles only. Mesonotum dark brown with lighter patches at the sides in front. Shoulders clad with deep golden-yellow ligulate scales, dorsum with dark brown and blackish-brown narrow-curved scales. Scutellum deep brown clad with black narrow-curved scales and six bristles on the central lobe. Pleuræ golden-brown with a few golden bristles and scales. Wings with small triangular median scales and a few elliptical lateral scales on the fork cells only. The scales on the third vein consist of a single median row of very dark brown scales of a triangular shape with concave free ends; fork cells short, of about equal length, the base of the first nearer the apex of the wing than the second, its stem about one and half times as long as the cell; supernumerary and median veins forming one straight line, posterior cross-vein bent on itself in the middle and placed very obliquely and distant from the median exactly the length of one wing scale. Coxae golden-brown with dark shading, fore coxæ with dark brown and golden-brown spatulate scales, hind with a double row of golden-brown scales on their whole length; femora purple above golden-brown beneath; tibiæ clad with bright purple scales and a ring of deep golden scales at the apex of each; in the fore and mid legs there is a well-marked creamy band at base and apex of metatarsus and at the base of the two first tarsal joints; in the hind leg there is a broad golden-yellow band at every articulation involving both sides of the joint while the whole of the last tarsal joint is creamy-yellow.

Abdomen.—Dorsally clad with rich purple and broad basal bands of eep golden-yellow scales, venter entirely golden-yellow.

Male.—With markedly plumose antennæ the joints being deep golden-ellow the plumes bright flaxen. The palpi about as long as the proboscis narkedly clavate, at the apex clad with deep golden-yellow scales and four ands of black scales one at the apex, one at the apex of the penultimate oint, another in its centre and a third imperfect one at its base.

In all other respects the male is ornamented as the female.

Occurrence.—Described from one male and female the male was caught n my bungalow Kuala Lumpur the female in the jungle at Raub.

Remarks.—A typical Conopomyia and easily distinguished from the ther species by its much richer colouring. Like Hybrida it has abdominal ands but the former has unbanded legs. C. Metallica has banded legs ut no abdominal bands but the abdomen has a central longitudinal stripe. In remarks on the genus I have commented on the points of resemblance of the mosquito to the genus Mimomyia and have also pointed out the difference.

Genus 20.—**Skusea.**—*Theobald.*

This genus was originally placed in the Sub-family Acdeomyinæ by Theobald in Vol. III of his "Monograph," and my genus Amauromyia exactly corresponds to it but in "Genera Insectorum" 26 me. Fascicule 1905, Theobald has transferred Skusea to the Culicinæ as the males have long palpi. This genus is unrepresented in Malaya.

Genus 21.—**Danielsia.**—*Theobald.*

Characters.—Head with elongated spatulate scales and a few narrow-curved behind on the nape and in front on the vertex. Scutellum with narrow-curved scales only male palpi as long as the proboscis.

Remarks.—This genus is founded on one species sent from Malaya. Its affinities are with Macleaya from which it is distinguished by the scutellar scaling and Acartomyia from which it differs in the male palpi being simple and not clavate as in the former. Except for the cephalic scaling it also differs but little from several species of culex.

[Danielsia Albotaeniata.—*Theobald.*]

Head clad with large spatulate scales, a few narrow-curved ones on the vertex and behind on the nape, and rows of deep brown upright scales. On the anterior two-thirds of the mesonotum is a broad band of silvery scales flanked on either side with bronzy narrow-curved scales, and from the posterior end of this white band white scales spread transversely outwards on either side to the base of each wing these bands forming with the central band an inverted "Y." The posterior third is clad with bronzy scales and an edging of silvery scales to the bare space in front of the scutellum. Fore legs with creamy band at the knee and tibio-metatarsal joints; mid legs with creamy band at base of metatarsus and first tarsal joint; hind legs with band on metatarsus and first three tarsal joints.

Female Head.—Deep brown to black : on the vertex between the eyes is a patch of silvery narrow-curved scales and there are a few silvery narrow-curved scales on the nape. On either side of the middle line is a band of silvery spatulate scales which about half way back spreads laterally as a transverse silvery band and this central line with silvery scales along the orbital margin and transverse silvery band behind and broad silvery lateral band encloses an oval area on either side clad with deep brown spatulate scales, while beyond the lateral silvery band of either side is a patch of deep brown scales succeeded by silvery-white scales ; vertical and orbital bristles dark brown ; upright scales behind deep brown. Basal joint of antenna brown with silvery scales on its inner face, second joint brown with deep purple-brown scale on its basal half, remaining joints dark brown with dark brown verticils. Palpi five-jointed, the first two joints round and small the third joint swollen, the fourth longer than the third, fifth minute, the whole palpus clad with deep brown scales. Proboscis clad with deep brown scales with a narrow band of creamy scales about the middle. This band is not always present and in some specimens it is incomplete above.

Thorax.—Prothoracic lobes very prominent deep brown and clad with silvery elliptical scales. Mesonotum slate-black clad with narrow curved scales ; the portion in front of the wings shews a broad band of silvery scales running lengthwise and a transverse band of similar scales running across opposite the roots of the wings ; on either side of the broad longitudinal band the mesonotum is clad with coppery-bronze scales and the posterior third is clad with similar scales with an edging of silvery scales around the bare space in front of the scutellum. Scutellum light brown with silvery narrow-curved scales and brown bristles of which there are four on the central lobe. Pleuræ dark brown with patches of snowy-white ligulate and narrow-curved scales. Wings clad with dark brown scales the lateral linear the median narrow ligulate ; first fork cell longer and narrower than the second, its base nearer the wing base, its stem about one-third the length of the cell ; posterior cross vein about twice its own length from the median. Coxæ creamy-yellow ; femora deep brown above and laterally, silvery beneath, except the hind femora which have two long patches of creamy scales laterally ; tibiæ deep brown with a basal and apical creamy ring ; metatarsus and first tarsal joint of fore and mid legs deep brown with a basal white band, remaining tarsi being deep brown. In the hind leg the metatarsus and first three tarsal joints have broad basal white bands ; ungues of fore and mid legs equal and uni-serrate, of hind equal and simple.

Abdomen.—Clad dorsally with deep brown scales and a narrow basal band of white on each segment after the first, the last segment shewing a large snowy-white patch ; the sixth and seventh segments have apical lateral spots ; venter clad with dingy white scales.

Male.—The head has more white scales than the female the two patches of brown being very small. The antennæ are plumose and the plumes are pale silky-brown. The anterior mesonotum is almost entirely white scaled the bronze scales forming only a small spot on either side. The abdominal bands are broader than in the female. Fore and mid ungues unequal and the larger unguis is bi-serrate the smaller uni-serrate. The palpi are as

ong as the proboscis are clad with deep brown scales the terminal have ale silky-brown hairs on them. The proboscis shews no band.

Occurrence.—Described from a series bred from larvæ taken from water ollected in cut bamboos.

Remarks.—An easily recognised mosquito the thoracic ornamentation eing quite unique. As far as I know this mosquito is entirely sylvan and reeds only in bamboos. It is a fairly common jungle species both on the lains and in the hills and is a vicious day-biter. A description of this nosquito was published from my notes sent to Mr. THEOBALD, in "The Entomologist" of April, 1904, and was named by Mr. THEOBALD. The present description is somewhat revised and is I think more accurate than my former one.

Genus 22.—**Lophoceratomyia.**—*Theobald.*

Palpi short in the female long in the male. Head clothed with narrow-curved scales in the centre. Spatulate or racquet-shaped scales at the sides (the latter come almost up to the middle line) and numerous upright forked scales. Thorax and scutellum with narrow-curved scales. Wings with fairly broad clavate scales which are massed towards the apex of the wing. Male antennæ with peculiar rows of scales on the sixth to tenth joints inclusive.

Remarks.—This genus contains species which closely resemble members of the genus culex. The genus was created by Mr. THEOBALD on certain species described by him in "A Catalogue of the Culicidæ in the Hungarian National Museum, 1905," and was founded on the peculiar appendages on the male antennæ. The wing scaling in all the Malayan species differs from culex, the anterior half of the wing having clavate lateral scales exactly resembling those figured on the wings of species of Melanoconion. The head scaling also differs from culex in having broad scales coming almost up to the middle line of the head there being fewer narrow-curved scales. I have nine species most of which are new. The females of this genus are difficult to distinguish one from the other and it is only by rearing species from larvæ I have been able to determine the particular species of some of the females.

LOPHOCERATOMYIA RUBITHORACIS. N. SP.

A small slender mosquito with a conspicuously reddish-brown thorax in the living specimen which changes after death to a yellowish-brown; it is sparsely clad with black narrow curved scales. The pleuræ and coxæ are pale and translucent. The legs are unspotted covered with purple-brown scales. The abdomen is dull purple-brown above without spots or bands though the scales being few the pale yellow abdomen shews through in places giving the abdomen a mottled appearance under a hand lens.

Female Head.—Pale brown along the orbital margins (when fresh) dark blackish-brown elsewhere; there is a margin of pale grey scales along the eyes, numerous linear slightly curved flaxen scales in the centre spreading out behind and among these dark olive-brown spatulate scales which extend laterally, and outside these a patch of bluish-grey spatulate scales; there are

numerous dark brown upright forked scales which are inserted as far forward as the orbital margins in the centre; vertical bristles pale brown, orbital dark brown. Basal joint of antenna dark brown, without scales, having a few inconspicuous hairs on the upper part of the inner face, second joint pale grey at the base darker at the apex clad with hairs but no scales, remaining joints brownish-black clad with numerous short pale hairs; verticillate hairs dark brown. Clypeus dark brown and nude. Palpi short, with four evident joints which are dark brown, the terminal joint being much enlarged and apparently it and the upper surface of penultimate joint are the only joints scaled. Labellæ light brown.

Thorax.—Prothoracic lobes, light muddy-brown, without scales, with a row of dark bristles on the antero-lateral margin. Mesonotum varies somewhat in colour, sometimes it is bright reddish-brown in other specimens the brown inclines more to a muddy or yellow tint; it is clad with narrow-curved scales which under a hand lens appear light bronze but under a 2/3 the separate scales are dark brown many of them having pale golden or grey tips, the anterior, alar, and præscutellar bristles are long and dark brown. Scutellum in colour and scaling resembles the mesonotum. Pleuræ pale muddy-yellow, when dry silvery, without scales, but with a row of bristles running down the centre in a vertical direction. Wings with a brown tint; scales on the costa dark brown almost black the rest of the wing scaled with dark brown scales; first long vein with a double row of small narrow spatulate median scales for the first two-thirds the last third shews in addition on its upper margin a row of scales which are at first linear but become clavate the nearer they get to the apex of the wing, second long vein clad with a single row of median scales until it divides when each branch has also lateral scales on either margin which become clavate as they approach the apex; the apices of third and fourth have similar scales, the branches of the fifth have a few linear lateral scales, the sixth has only median scales; fork cells short, first longer and slightly narrower than second, its base a little nearer the wing base, its stem two-thirds the length of the cell; supernumerary and median cross veins meeting at a very open angle, posterior cross vein scarcely twice its length from median. Coxæ silvery-white; fore coxæ scaled in front, trochanters and under part of thighs silvery; on the hind femora the silvery scaling is extended on to the sides and the base; the rest of the leg is clad with dark brown scales, with purple reflections. Ungues equal and simple on all legs.

Abdomen.—Clad above with scales which generally appear of a dull dark brown though they also shew purple tints in some lights. There is a paleness at the base of the segments but no true banding. The venter is silvery but this is only seen in the freshly killed specimen.

Male Head.—Scaled as in the female. Basal joint of antenna dark brown without scales, the remaining joints except the last two have a dark brown ring at the insertion of the verticils, the rest of each joint being semi-translucent with a dusky-brown tint; on the inner face of joints two to five inclusive the verticillate hairs are replaced by short bristly hairs; on the sixth joint just at the junction of its upper and outer faces there is a tuft of yellowish-brown scales generally four in number; these scales are about

alf as long as the verticillate hairs are narrow and have long hair-like oints, they do not I am certain replace the verticillate hairs for in a ounted antenna under a high power one can see the scales are inserted elow the ring which carries the hairs and hairs can be seen just above the cale insertions, moreover the joint is enlarged at this point; the next three oints all have a tubercular enlargement on their outer faces and carry a ow of dark brown scales, but these instead of being straight have ends vith a double curve exactly as though they had been folded and then failed o expand, this is particularly noticeable in the scales on the eighth joint less o in those on the ninth where the scales are much longer. The antenna as a distinct ridge about the region of these joints seen even with a very ow power lens. In L. Variatus the Antennæ are much the same but the vhole mosquito is much darker, the head has no distinct pale orbital margin r lateral patches. The thorax under a lens looks almost black instead of eddish-brown and the mosquito is larger. The larvæ are readily distinguished under the microscope. Still the difference being mainly one of olour and size both variable qualities there is no doubt the distinction is not asy. The verticillate hairs at the two extremes of the antennæ are dark urple-brown but those on the central joints have pale flaxen bases being urple-brown beyond. The two last joints are elongated as usual. These re slender longer than the proboscis by the two terminal joints which urve upwards and are very hairy. They are without bands being clad vith dark brown scales. The proboscis is similarly scaled. The colour nd scaling of thorax legs and wings resembles the female. Fore and mid ngues unequal the larger tooth very pointed and uni-serrate.

Occurrence.—Described from a series bred from larvæ taken in ponds n Kuala Lumpur.

Remarks.—The brilliant red thorax the small size and the scales on the nale antennæ distinguish this mosquito from varieties which in other espects it somewhat resembles.

Lophoceratomyia Variata. n. sp.

A rather variable mosquito as to colour some specimens being much larker than others. Thorax sometimes bright ferruginous sometimes vellowish-brown and at times a kind of dark olive-green; clad with bronzy scales. Coxæ pallid, legs and abdomen dark purple-brown without bands or spots.

Female Head.—Deep brown in the centre clad with pale brown (grey in a strong light) linear scales slightly curved which spread out behind forming a triangular patch. Among these and coming almost up to the middle are dark olive-brown spatulate scales which extend laterally where they meet a large patch of bluish-grey spatulate scales; along the orbital margin of either side is a row of silvery-grey elliptical scales forming a pale margin; numerous dark brown upright scales are inserted behind and as far forwards as the vertex; orbital and vertical bristles brown with pale grey tips. Basal joint of antenna dark brown apparently without scales, remaining joints dusky-brown with silvery down and dark brown verticillate hairs. Palpi about one-sixth the length of the proboscis clad with dark brown scales. Proboscis clad with dark brown scales.

Thorax.—Prothoracic lobes dark brown with bristles only. Mesonotum bright ferruginous or paler yellowish-brown or greenish-black, according to the length of time the specimen has been born; it is entirely clad with bronzy or dark brown narrow-curved scales and rows of dark brown bristles. The scutellum is in colour the same as the mesonotum and is clad with similar scales; bristles to the mid lobe dark brown and usually four in number. Pleuræ dusky-brown with a patch of small spatulate silvery scales. Wings clad with brown scales of the generic type that is the lateral scales towards the apex of the wing are broadly clavate; fork cells of about equal breadth, the first longer than the second, its base slightly nearer the apex of the wing, its stem about two-thirds the length of the cell; supernumerary and mid cross veins almost in a line, posterior cross vein twice its own length from the mid. Coxæ creamy translucent and with bristles only. Legs entirely clad with dark brown scales with purple reflections in some lights on the scales on the tarsi appear coppery. Ungues equal and simple.

Abdomen.—Clad with dark brown scales above silvery-grey scales beneath.

Male.—Head as in the female with pale grey narrow-curved scales in the centre on either side of a bare line, spatulate lateral scales of a greyish-blue or pale olive-brown set like tiles on a roof at the sides but becoming less dense as the middle line is approached. These flat scales come right up to the middle in front but gradually diverge from the vertex forming a triangular space which is the portion clad with narrow-curved scales. The general tint is lighter than that in the female. Basal joint of antenna very large dark brown in colour and without scales. Succeeding joints to the tenth very thick and with dark brown crescentic ridges on which the verticillate hairs and the peculiar scales about to be described are inserted; on the sixth joint is a prominent ridge on the outer and upper surface and upon this a row of long slightly clavate dark brown scales are inserted. These scales are about as long as four antennal joints they stand well out from their insertion and curve slightly forwards, on the seventh, eighth and ninth joints there is a prominent ridge on the inner side for the insertion of deep brown scales of a peculiar shape the appearance presented is that of a bunch of scales which have been crumpled and has not straightened out again, on the tenth segment there are a few needle-like yellowish-brown scales looking inwards; the verticillate hairs are dark brown and very dense and the two last antennal joints together are longer than the whole of the remainder of the antenna. Palpi longer than the proboscis by their two last joints which are clad with rows of long hairs and in the natural state are turned upwards as in culex. Proboscis and palpi clad with dark brown scales. At the base of each palpus is a curious finger-like process clad with hairs which is peculiar to some of the males of this genus.

As in the female the colour of the mesonotum varies much and as it is thinly scaled its colour is a distinct feature in the appearance of any particular specimen, thus changes in the colour of this part in specimens may cause any two specimens to appear very unlike each other. Dark reddish-brown or dark brown with purple patches or lines or light yellowish-brown are the usual colours seen. The genital lobes seem to have two processes at

heir ends one quarter-curved light yellowish chitinous hook and the other rocess is a broad chitinous basal piece bearing numerous stiff hairs on its nd like a brush. The fore ungues are markedly unequal, the larger unguis toothed and much more curved than the smaller. The mid unguis re unequal but I cannot see a tooth on either hind equal and simple.

Occurrence.—Described from a large series bred from larvæ generally ound in small ponds and puddles in swampy ground.

Remarks.—This species is found in similar situation to the previous one, iz., settling on low herbage in the neighbourhood of ponds and swampy round. It is apparently not common in houses unless they are built in close roximity to the above. It does not bite or at least very rarely so. It is istinguished from L. Rubithoracis by its larger size and larger scales on the ale antennæ. The larvæ are also distinct.

[Lophoceratomyia Niger. n. sp.]

A very sombre-coloured mosquito which in some lights looks black but n a good light the colour shews as a very dark brown with a purple tinge. Thorax brown, posteriorly yellowish-brown covered with blackish-brown cales. Head with a dark grey margin to the eyes dark purple scales in he centre and a small patch of blue-grey scales low down laterally. Legs nbanded with dark brown scales. Abdomen dark brown, almost black bove, with small white lateral spots and basal pale bands on the venter. These disappear in the dried specimen.

Female Head.—Muddy-brown along the orbital margins, dark brown lsewhere. There are no scales on the light brown portion and under a and lens this gives the appearance of a pale orbital margin, lost in the ry specimen. In the dried specimen the brown orbital margin disappears nd the whole head darkens and appears to be covered with black scales vith a few dark grey scales scattered irregularly over it; the upper portion f the head is entirely covered with flat racquet-shaped scales which are lue-black in colour or in some lights dark grey. I believe these scales ome right up to the middle but they are exceedingly difficult to make out gainst the almost black coloured head; there is a triangular patch of pale grey narrow-curved scales with its apex at the vertex its base behind; hese are inserted among the flat scales. Dark brown upright forked cales also extend forwards as far as the orbital margins backwards to the ccipital foramen and laterally as far as two patches of blue-grey scales. Basal joint of antennæ glistening blackish-brown without scales, remaining joints dark brown clad with pale hairs; verticillate hairs dark brown. Clypeus dark brown nude. Palpi three evident joints; apparent last joint as ong as the other two clad with black-brown scales. Proboscis enlarged at he apex the enlargement being very gradual, clad with black-brown scales; abellæ light brown.

Thorax.—Prothoracic lobes prominent, dark brown, with antero-lateral row of dark brown bristles but without scales. Mesonotum muddy-brown with dark brown lines anteriorly darkening as the specimen dries, clad with dark black-brown narrow-curved scales some of which have pale grey tips. The usual thoracic bristles are present which are black-brown in colour. Scutellum in colour and scales resembles the mesonotum. Pleura muddy-

brown with dark brown patches. Wings; anterior edge of costa armed with spindle-like scales black-brown in colour, first long vein clad with double row of small spatulate median scales on its basal half, with broad clavate scales on the upper margin of the apical half and a single median row, second vein commences with a single median row which becomes double just before the supernumerary cross vein and its branches are clad with three or four rows of clavate scales which become broader the nearer they are to the apex of the wing, third vein has a single median row at its base further on linear lateral scales appear and still nearer the apex the lateral scales become clavate, fourth has a median row, its branches have lateral clavate scales though they are not as heavily scaled as are the branches of the second vein, fifth vein single median row and lanceolate lateral scales, sixth vein has a very few lanceolate lateral scales at its apex; fork cells short, first a little longer than second, its base nearer the wing apex, its stem rather more than two-thirds the length of the cell; supernumerary and median cross veins almost in a line, posterior cross vein about three times its length from mid. Coxæ trochanters and base of the femora colourless, under surface of the femora silvery-white, on the hind femora this white scaling at the base is extended on to the lateral faces. The rest of the legs covered with dark brown scales without spots or bands. Fore and mid ungues simple and equal.

Abdomen.—Clad above with dark black-brown scales; there are small white basal lateral spots and ventrally the bases of the segments are clad with creamy-white scales. The dark scales above are rich purple if looked at against the light.

Male Head.—Scaled as in the female. Basal joints of antenna large and dark brown without scales, remaining joints black, where the verticillate hairs are inserted on two lateral crescentic chitinous thickenings pale black elsewhere, sixth joint with a few yellowish-brown lanceolate scales on the outer face, seventh and eighth joints with a tubercular eminence on the outer side of each on which is inserted a row of dark brown scales with their ends shewing a double curve as though they had been crumpled these scales seem to replace the verticillate hairs on the side they are inserted. On the ninth and tenth joints there are also a few straight lanceolate dark brown scales, those on the eleventh joint being much longer than those on the ninth, on these joints the verticillate hairs are inserted all round as usual the scales being inserted immediately below them but not replacing them verticillate hairs dark purple-brown; on the central joints they are pale flaxen at the base. Palpi long and slender, longer than the proboscis by two joints which are turned upwards and are very hairy. The palpi are clad with dark purple-brown scales as is the proboscis. Thorax, wings and legs in colour and scaling resemble the female. Fore and mid ungues unequal the larger unguis being uni-serrate.

Occurrence.—Described from a series bred from larvæ taken in ponds in Kuala Lumpur.

Remarks.—The antennæ of this mosquito resemble very closely those of L. Rubithoracis but there are differences best seen with a mounted head under a fairly high power. The scales on the sixth joint are much longer and darker than those on the same joints in the male antenna of

.. Rubithoracis the scales on the eighth and ninth joints are longer in .. Rubithoracis than in this mosquito while on the tenth joint there are no :ales in L. Rubithoracis. The mosquitoes differ in colour L. Rubithoracis eing much lighter and the wing scales on the male of this mosquito are eavier and broader than those on the wing of the male L. Rubithoracis.

Lophoceratomyia Sylvestris. n. sp.

Head with well-marked silvery orbital margin and golden vertical ristles. Thorax blackish-brown, pleura greenish; proboscis, legs and bdomen blackish-brown.

Female Head.—Blackish-brown with a row of silvery elliptical scales long the orbital margin of either side, pale brown narrow-curved scales in ne centre, and outside these a few spatulate scales which take the colour f the background, and beyond these a patch of blue-grey spatulate scales; pright forked scales dark brown and inserted over the whole of the upper ortion of the head; on the vertex are two conspicuous golden bristles. ll the above may be much altered when the specimen drys the silvery rbital margin entirely disappearing as that part shrinks beneath the darker ortion of the head. Basal joint of antenna dark brown with silvery hairs nd dark brown verticillate hairs. Palpi about one-sixth the length of the roboscis clad with scales which are almost black. Proboscis clad with rown scales, bronze-purple in some lights.

Thorax.—Prothoracic lobes dull black, without scales. Mesonotum usky, clad with bronzy narrow-curved scales. Scutellum paler than the nesonotum clad with black narrow-curved scales and with dark brown ristles, four to the central lobe. Pleuræ colourless usually green tinted rom thoracic contents. Wings clad with dark brown scales of the usual type; ork cells long, the first longer and narrower than the second, its base slightly earer the wing base, its stem scarcely half the length of the cell; posterior ross-vein three times its own length from the median. Coxæ colourless clad vith a few white scales. Femora dull white beneath dark brown above nd laterally; remainder of legs with dark purple-brown scales; ungues qual and simple.

Abdomen.—Clad with blackish-brown scales above dirty-white beneath.

Male.—Head with well marked silvery line of scales along the orbital nargins and in addition there are a few silvery narrow-curved scales on the ertex and laterally the scales are paler than those on the female head. The basal joint of antenna is not such a dark brown as that in the female; emaining joints pale silvery-brown with dark brown crescentic ridges for he insertions of the verticils. The scale tuft on the sixth joint is confined o the outer side; it consists of a few (four or five at the most) dark brown eedle-like scales; the tufts of crumpled scales on the seventh, eighth and inth joints exactly resemble those in L. Variata; the verticillate hairs n the joints beyond the tenth are very long and at their bases are bright flaxen. Fore and mid ungues unequal the larger uni-serrate.

Occurrence.—Bred from larvæ found in the still pools in the jungle.

Remarks.— This mosquito somewhat resembles M. Niger but should not be difficult to distinguish from that species. The white line along the

orbital margins the length of the fork cells on the wing are the chief point of difference in the adults. The larvæ differ and are not found in the same places M. Niger breeding in swamps in the open while this mosquito seems to be entirely sylvan and breeds only in jungle pools. The scales on the sixth joint of the male antenna are longer and broader in this species than those on the same joint of the male antenna in L. Niger.

Lophoceratomyia Minor. n. sp.

A small dull-coloured mosquito with the whole body of a greenish tinge from the colour of the contents. There is a silvery line along the eyes; but the abdomen and legs are clothed with dark brown scales.

Female Head.—Deep purple to black; along the orbital margin of either side silvery-white narrow-curved scales are loosely arranged to form a fairly broad band, the rest of the upper surface of the head is very thinly covered with scattered narrow-curved scales which are copper coloured or yellowish brown according to the amount and direction of the light, and outside these there is a patch of broad spatulate greyish-blue scales, and over the whole upper part of the head there are rows of very long upright forked scales dark brown or in more light coppery-brown. Basal joint of antenna dark brown, remaining joints dusky-brown with dark brown verticils. Palpi about one-sixth the length of the proboscis clad with dark brown scales. Proboscis clad with dark brown scales.

Thorax.—Prothoracic lobes dusky without scales. Mesonotum of dirty white translucent and allowing the thoracic contents to shew through giving the thorax a greenish tinge; in the centre of the mesonotum is a broad dark line; the whole is clad with black and coppery-brown narrow curved scales mixed indiscriminately. Scutellum resembles the mesonotum in colour and scaling. Pleuræ translucent with a greenish tinge due to contents of thorax shewing through. Wings with only linear lateral scales and rather long spatulate median, no clavate scales as in other members of this genus; first fork cell longer and slightly narrower than the second, its base nearer the wing base, its stem rather more than half the length of the cell; posterior cross vein nearly three times its own length from the median. Coxæ colourless. Legs clad with dark brown scales with purple reflections. Under sides of femora creamy-white. The ungues equal and simple on all the legs. On the fore legs the empodium is developed to a very much greater extent than in any other mosquito I have seen.

Abdomen.—Dark blackish-brown above, bronze-purple in some lights and dirty greenish-white beneath.

Male.—Head with a less conspicuous silvery band to the orbits. Basal joint of antenna with a curious sulcus crossing its inner and lower face cutting off a small upper portion from the larger lower part. That this is not produced by distortion in drying is proved by its presence in a large number of specimens and in fresh specimens. The second antennal joint is colourless and very thick and short; the sixth joint bears on a thick raised crescentic ridge on its outer side a row of lanceolate scales, some golden-brown, others dark brown; joints seven, eight and nine bear tufts of crumpled scales as described under some of the other species of this genus; verticillate hairs long and dense dark olive-brown in colour. Palpi very

lender, longer than the proboscis by their last joint, which joint has a tout spine at its apex. Genitalia with brush-like claspers golden-brown. Fore and mid ungues unequal but it is curious that the larger unguis is simple and the smaller toothed.

Occurrence.—Described from a series bred from larvæ taken from water collected in open bamboos.

Remarks.—This mosquito is entirely sylvan. It is the smallest of the Malayan species and is very dull coloured and slender. The colouring of the exoskeleton is so feeble that it is merged in the greenish tint from the contents of the body. As it is entirely a bamboo-breeder it is another example of the selective habits with regard to breeding of certain species of mosquitoes. The male ungues resemble those figured by THEOBALD as those of L. Brevipalpus and they are decidedly unique in having the smaller unguis toothed and the larger simple.

LOPHOCERATOMYIA TÆNIATA. N. SP.

Head deep purple-black with golden-brown narrow scales and bluish-grey spatulate scales at the sides. Proboscis palpi and legs dark brown. Thorax dark reddish-brown. Abdominal segments with dingy-white basal bands.

Female Head.—Dark purple-black; above, is a triangular area, thinly clad with pale brown narrow-curved scales, on either side of this there are some dark brown spatulate scales difficult to see against the dark background and outside these on either side is a patch of blue-grey spatulate scales; vertical bristles pale brown; rows of dark brown upright scales are inserted all over the upper surface as far forwards as the vertex. Basal joint of antenna deep purple, without scales, remaining joints dusky-brown with numerous short silvery hairs and deep brown verticillate hairs. Clypeus blackish-brown. Palpi about one-seventh the length of the proboscis clad with dark purple-brown scales like the proboscis.

Thorax.—Prothoracic lobes dark chestnut-brown with bristles only. Mesonotum deep chestnut-brown or lighter reddish-brown in some specimens with black and coppery-brown narrow-curved scales and long dark brown bristles. Scutellum brown with golden-brown narrow-curved scales and dark brown bristles, the number on the central lobe being five or six. Pleuræ with chestnut-brown and paler yellowish-brown patches. Wings smoky, with dark brown scales which where massed, as on the costa, appear rich purple; lateral scales clavate and massed towards the apex of the wing; fork cells of medium length, first longer and slightly narrower than the second, its base nearer the wing base, its stem about half as long as the cell; posterior cross vein a little more than its own length from the median. Coxæ light brown with spatulate scales on fore and mid; femora with dark brown scales except on the under side which is clad with creamy scales; mid femora enlarged, scaled like the fore; hind femora dark brown above in their whole length, creamy beneath and at the base, laterally clad with creamy scales, at the apex dark brown; remainder of all legs with dark purple-brown scales. Ungues equal and simple on all legs. Empodium large.

Abdomen.—Clad above with dark purple-brown scales with pale creamy-white basal bands to the segments; venter with creamy scales, which become dingy-yellow in an old specimen as the scales lose their lustre and take the tint of their background.

Male.—Head as in the female. Antennæ densely plumose, the verticillate hairs being fawn-brown; on the sixth joint is a row of dark brown lanceolate scales which are inserted on the outer side and towards the central surface which makes them difficult to see; on the seventh and eighth joints there are the usual dark brown crumpled scales described under other members of this genus. The palpi are longer than the proboscis by their last joint; they are clad with dark brown scales and the two last joints bear long hairs like the same joints in culex. The fore and mid ungues are markedly unequal and the larger unguis on the fore leg bears one tooth. Hind ungues equal and simple.

Occurrence.—Described from a series bred from larvæ taken in a pond in the open near Kuala Lumpur and in a similar piece of water at Klang.

Remarks.—A very distinct species easily recognised by the banded abdomen.

Lophoceratomyia Mammilifer. n. sp.

Head almost black with short clavate scales laterally and above almost to the middle line, and some dark brown narrow-curved scales on the central area; a band of silvery scales along the orbital margins. Thorax light brown with bronzy narrow-curved scales. Abdomen and legs with dark brown scales. Basal joint of male antenna with a peculiar teat-like projection on its upper inner angle.

Female Head.—Dark purple or black. Along either orbital margin is a silvery band composed of two rows of silvery clavate scales; on the central area is a triangular patch of narrow-curved scales dark brown in colour seen with great difficulty as except in a very strong light they are indistinguishable from their dark background; laterally clavate scales are inserted in imbricate rows white in colour and scales of similar shape but dark brown in colour are inserted amongst the narrow-curved scales almost up to the middle line. These scales are not at all like the ordinary broad lateral scales seen on the head of culex and others but are definitely club-shaped and in the male these are elliptical. Numerous long dark brown upright scales are inserted in rows over the whole upper surface of the head. Basal joint of antenna dark purple apparently without scales but as they are retracted into the head it is difficult to be sure of this; second joint light yellowish-brown at the base, black at the apex without scales, remaining joints dusky with dark brown verticils. Clypeus dark brown. Palpi about one-sixth the length of the proboscis clad with dark brown scales like the proboscis.

Thorax.—Prothoracic lobes dark blackish-brown with hairs only. Mesonotum under a hand lens dark brown with bronzy scales but under a higher power the sides of the anterior portion of mesonotum appear of a dirty white the centre being almost black with dark purple patches behind while the bare space in front of the scutellum is dirty white; the whole is

ad with hair-like black and bronzy scales. Scutellum ochraceous with lack hair-like scales and black bristles, there being four such to the central be. Pleuræ ochraceous with hairs only. Wings clad with dark brown cales the lateral being more numerous and distinctly clavate on the apical ortions of the veins; the basal three-fourths of each vein is without lateral cales being clad with narrow spatulate median scales; first fork longer ian the second with its base nearer the base of the wing, its stem rather iore than half the length of the cell; posterior cross less than twice its own ngth from the median. Coxæ colourless. Under sides of femora silvery nd in the hind femora the sides are silvery and the upper portion of the asal half. Ungues equal and simple on all the legs; empodium well eveloped.

Abdomen.—Black scaled above, silvery beneath.

Male.—Silvery scales more numerous than in the female, the scales ver all the head except a small triangular portion in the centre being ilvery. The shape of the scales are well seen on the male head, they are istinctly piriform and fusiform, they are thinly spread and do not overlap ne another. The basal joint of the antenna is very large and from its pper angle on the inner side a large teat-like projection projects, this is ell seen even in the dried specimens and as it is equally well seen in a reshly killed specimen it is quite evident it is not brought about by istortion; on the sixth joint is a raised ridge on the outer side and inserted n this are three or four stout dark brown scales with bluntly-rounded ends nd parallel edges, and some needle-like golden-brown scales; the seventh oint bears a row of dark brown crumpled scales, and on the eighth joint is row of short scales like the teeth of a comb. The palpi are long and lender, the last joint has a terminal spine but neither on the ultimate or enultimate joints are there any long hairs as seen in Culex; the base of he palpi is bent with small sharp spines on its outer side. The fore ungues re markedly unequal and the larger one is uni-serrate and possibly the maller.

Occurrence.—Described from a series of males and one female bred from arvæ from pools in jungle at Raub and near Kuala Lumpur.

Remarks.—Easily distinguished from all other species of this genus by the eculiar male antennæ and the shape of the head scales in both sexes. It s not a very large mosquito and like all the members of this genus dull-oloured. Since writing this Theobald has described two species of this enus one of which L. Brevipalpus has the same teat-like projection on the asal joint of the male antenna but the male palpi in his species are shorter han the proboscis and there can therefore be no difficulty in separating he species.

Lophoceratomyia Brevipalpus.—*Theobald.*

Head deep brown, some golden scales around the eyes; female palpi much horter than the proboscis, brown; proboscis fairly long, yellowish-brown to leep brown, swelling apically. Antennæ with distinct prominence on inner ide of basal joint; antennal organs smaller than in L. Fraudatrix.* Thorax

* This is not a Malayan species but is described by Theobald in "A Catalogue of Culicidæ in the Hungarian National Museum.—Theobald 1905."

deep brown, shiny with brown scales, a line of grey scales on each side in front of the wings; pleuræ yellowish-brown. Abdomen black dorsally, base of venter yellowish. Legs deep brown, coxæ and venter of femora yellowish.

Male.—Head deep brown with very small narrow-curved dull brown scales, slightly golden around the eyes and with numerous deep ochreous upright forked scales and small flat dull brown ones laterally; palpi shorter than the proboscis, thin, scaly, brown except at the actual base where they are testaceous, the two apical joints are small, the penultimate a little longer than the apical one, apex bristly (the exact number of joints cannot be made out owing to the scales). Clypeus small, rather long and bright testaceous. Proboscis brown, yellowish-brown at the base, fairly long and swollen apically. Antennæ with the basal joint brown with a hoary sheen, testaceous in the cup-like depression and with a very pronounced blunt prominence on the inner side the prominence having fine hairs on one portion, the four following joints normal, the sixth to ninth with varied processes, the two long apical joints very pubescent. Thorax deep shiny brown with scattered bronzy-brown narrow-curved scales, at the base of the wings the integument is pallid; prothoracic lobes with dull grey flat scales; scutellum testaceous with small narrow-curved black scales and four black bristles to the mid lobe; pleuræ ochreous-brown.

Abdomen violet-black with bronzy reflections in certain lights, basal segment bright testaceous with two spots of black scales; venter brown aspically, yellowish-brown to ochreous basally; hairs brown.

Legs uniformly brown with bronzy reflections, coxæ pale ochreous and also venter of femora; ungues of the fore legs unequal, the larger carved and thick and uni-serrated, the smaller simple; the mid unequal, the larger much carved and simple, the smaller uni-serrated; hind very small equal, simple and carved.

Wings with the fork-cells short, the first submarginal longer and narrow than the second posterior cell, its base nearer the base of the wing than that of the second posterior cell, its stem more than two-thirds the length of the cell; stem of the second posterior a little longer than the cell; supernumerary cross-vein shorter than the mid, the mid longer than the posterior cross-vein, the latter about three times its own length distant from the mid; scales on the branches of the fork-cells Taeniorhynchus-like but small; on the stems and on the fifth and sixth median-vein scales are alone present. Halteres with pale stem; and slightly fuscous knob.

Length: 4.5 mm.

Habitat: Singapore (Bir'o, 1902).

Observations.—Described from a single perfect male. In spite of the shorter palpi and the strange prominence on the basal antennal joint I place this species in this genus as the peculiar antennal organs are so very similar as well as all the aquamose characters. I have been unable to draw the antennal organs in detail as I could not break up the type. It can easily be distinguished from L. fraudatrix by the smaller size of the antennal organs and their different structure.

Remarks.—The above species is described by Theobald in "A Catalogue of the Culicidæ in the Hungarian Museum 1905," and the description is

taken from this Catalogue as I have no specimen of this mosquito. Under "Remarks" in L. Eminentia the differences between that and the present species are pointed out and there should be no difficulty in distinguishing the one from the other.

Lophoceratomyia Eminentia. n. sp.

Head clothed with golden narrow curved scales in the centre, pale scales along the orbital margins, brown clavate lateral scales, and numerous golden-brown upright scales. Thorax dark brown.

Head (*Male*).—Dark brown clad with golden narrow-curved scales in the centre silvery-grey clavate scales along the orbital margins, and dark brown elliptical scales laterally, and loosely scattered among the narrow-curved scales above and over the whole upper surface inserted amongst the other scales are golden-brown upright scales. Basal joint of antenna dark chestnut-brown without scales, remaining joints short, thick, and black in colour; on the sixth joint is a raised ridge on its outer surface and on this a row of bright golden-brown scales is inserted, on the seventh, eighth and ninth joints is a row of black crumpled scales; verticillate hairs very dense, long, and black in colour.. Clypeus deep blackish-brown. Palpi very slender not quite as long as the proboscis and clad with almost black scales as is the proboscis.

Prothoracic lobes very large and prominent, blackish-brown and without scales. Mesonotum almost black with slightly paler patches on the sides in front, thinly clad with black and olive-brown hair-like scales and numerous long black bristles. Scutellum light yellowish-brown with black narrow-curved scales and bristles, there being four to the central lobe. Pleuræ dark brown with areas of paler yellowish-brown with pale clavate scales and a few golden bristles. Wings clad with dark brown scales, the lateral scales on the fork cells are short and clavate, first fork cell longer and narrower than the second, its base nearer the base of the wing, its stem rather more than half the length of the cell; posterior cross vein more than twice its length from the median. Coxæ colourless. Legs clad with deep brown scales, except the under sides of the fore and mid femora and whole of the basal half of the hind femora; fore ungues unequal the larger uni-serrate, the smaller simple; mid ungues unequal but not toothed, hind equal and simple. Hind tibiæ with long black spines.

Abdomen.—Black scaled above, creamy beneath. Genetalia golden-brown there being two processes inserted on the apex of each genital lobe.

Occurrence.—Described from one male caught in the jungle near Kuala Lumpur.

Remarks.—A very distinct and easily recognised Lophoceratomyia presenting some peculiar features notably the short palpi and the golden-brown tuft of scales on the antennae. It resembles brevipalpus in having palpi shorter than the proboscis, it differs from that species in the absence of the mammiliform projection on the basal joint of antenna the untoothed mid ungues and the golden scales on the sixth antennal joint.

Genus 23.—**Lepidotomyia.**—*Theobald.*

Head with central narrow-curved scales and lateral spatulate scales the latter approaching nearer the middle line than in culex. Female palps short male longer than the proboscis but not so much longer as the palpi in Culex. Prothoracic lobes with narrow-curved and small spatulate scales. Scutellum with densely packed scales about twice as long as broad and having their free ends serrated. Knee spots glistening white. Wings much as in culex but the scales are rather broader.

Remarks.—There is some confusion about the generic characters of this genus as Theobald states in "A Catalogue of the Culicidæ in the Hungarian National Museum" that the scutellum is entirely clad with flat scales and in the "Genera Insectorum, Diptera, Fam. Culicidæ" he says the scutellum is clad with narrow-curved scales only. The first specimen examined by Theobald of this genus was one sent from the Malay States by me, but as he only had a female he did not care to classify the specimen. Subsequently I obtained males and also another species. The peculiar scutellar scales are the chief reason for separating these mosquitoes from Culex and I have therefore chosen the characters given me in the "Catalogue of the Culicidæ of the Hungarian Museum" as the true ones and regard the generic characters given in the "Genera Insectorum" as an error.

Lepidotomyia Alboscutellata.

Head dark ferruginous with pale golden narrow-curved scales in the centre patches of dark brown and white spatulate scales laterally; numerous dark brown upright scales scattered over the upper surface. Thorax ferruginous. Scutellum with brilliant pearly-white spatulate scales. A brilliant pearly-white spot at the base of each wing and pearly-white knee spots.

Female Head.—Deep brown, in some specimens dark ferruginous; central area clad with scattered pale golden narrow-curved scales, on either side of these a patch of dark brown spatulate scales (bronze-purple in some lights) and outside these a band of white spatulate scales, and dark brown upright scales over the whole upper surface. Basal joint of antenna dark brown with a few dark scales on its inner face, base of second joint pale yellow, remaining joints dark brown with dark brown verticillate hairs. Clypeus deep purple. Palpi about one-fifth the length of the proboscis clad with dark brown scales. Proboscis with dark brown scales.

Thorax.—Prothoracic lobes dark brown with a few pale spatulate scales. Mesonotum deep ferruginous with pale golden narrow-curved scales on the anterior margins and golden-brown scales over the dorsum. Scutellum ferruginous, each lobe completely covered with closely packed brilliant pearly-white scales; these scales are spatulate with the free ends serrated. Pleuræ ferruginous with patches of scales similar to those on the scutellum. Wings clad with dark brown scales the median rather long square or oblique-ended narrow scales, the lateral broadly linear with abruptly truncated ends. Fork cells short, first longer and narrower than second, its base nearer the wing apex, its stem as long as the cell; posterior cross-vein about its own length from the

nedian. Coxæ light brown ; femora silvery beneath and dark brown above with a patch of brilliant pearly-white scales at the apex of each ; tibia dark purple-brown with a conspicuous patch of pearly-white scales on the upper surface of the apex of each ; fore and mid ungues equal and uni-serrate.

Abdomen.—Clad with dark brown scales. The free edge of each segment bears a fringe of pale golden hairs.

Male.—Antennæ with light fawn-brown plumes. Palpi longer than the proboscis, last two joints of equal length and densely hairy ; penultimate joint much thicker than the ultimate clad with black scales, antepenultimate joint very slender except at the apex which is enlarged and black scaled. Abdominal segments with broad dingy-white basal bands. Last segment with two pearly-white spots on the dorsum. Fore and mid ungues unequal and each unguis bearing a tooth.

Occurrence.—Described from a series of adults captured in jungle round Kuala Lumpur and from others bred from larvæ found in a jungle pool.

Remarks.—A very distinct and easily recognised mosquito the white scutellum, knee spots and the spot on each wing at its base and at the apex of mid and hind tibiæ being very conspicuous and characteristic. The absence of banding on the tarsi easily distinguishes it from L. Taeniata and I do not know any other mosquito here it could possibly be mistaken for. It is very local but where present fairly common. It is an active blood sucker. First described by Theobald in "Catalogue of the Culicidæ in the Hungarian National Museum." The male is described here for the first time.

Lepidotomyia Taeniata. n. sp.

Upper part of head with bright golden scales, sides with a black spot followed by a band of pale golden scales succeeded by black. Palpi white-tipped. Scutellum with brilliant pearly-white scales. Knee spots and tibio-metatarsal articulations pearly-white. Three broad creamy-yellow bands on the hind leg.

Female Head.—Deep brown almost black ; upper surface clad with scattered golden narrow-curved scales which are massed along the upper half of the orbital margin to form a golden line ; outside these on either side is a round patch of black spatulate scales succeeded by a band of pale golden spatulate scales which are followed by deep brown or black scales; numerous black upright scales are inserted over the whole upper surface. Basal joint of antenna yellowish-brown, darker on the inner face, remaining joints dark brown with dark brown verticils. Clypeus black. Palpi clad with blackish-brown scales and pearly-white ones at the tip. Proboscis clad with black scales.

Thorax.—Prothoracic lobes deep brown with golden narrow-curved and small spatulate scales. Mesonotum ferruginous with three dark brown lines ; anterior margin and shoulder clad with bright golden narrow-curved scales and there is a small spot of similar scales on either side at the level of the junction of anterior and middle thirds ; remainder of mesonotum clad with black and golden-brown narrow-curved scales. Scutellum light brown, each lobe clad with pearly-white rather long broad scales with the free ends

serrated. Pleuræ light brown with patches of white scales. Wings with dark brown scales, median elongated spatulate, the lateral broadly linear or slightly clavate; first fork cell longer and much narrower than the second, its base nearer the wing base, its stem about two-thirds the length of the cell; posterior cross vein distant its own length from the median. Femora with deep brown scales (except the hind which are silvery beneath) and a spot of pearly-white scales on the apex; tibia similarly clad but only the fore tibiæ shew the white scales at the apex; mid and hind metatarsi with a broad creamy-yellow basal band; first three tarsal joints of hind leg with a broad creamy-yellow band, fourth joint entirely creamy. In some specimens the metatarsus of the fore legs has a creamy band and sometimes the first tarsal joint of the mid leg. Ungues equal and uni-serrate.

Abdomen.—Blackish-brown above with large white lateral spots.

Male.—The antenna are plumose, the plumes being bright silky-brown in colour. Palpi longer than the proboscis and the two last joints are clad with black scales with a ring of white scales at their bases, and each joint bears two rows of long pale brown hairs; the antepenultimate joint shews a creamy band in its centre and the proboscis is banded in the same place. Segments five and six of the abdomen have broad white basal bands and the eighth segment is completely clad with brilliant pearly-white scales. Fore and mid ungues unequal and each unguis bears a tooth in both legs.

Occurrence.—Described from large series bred from larvæ taken in water collected in ruts in a jungle waggon track.

Remarks.—An excellent proof of how curiously local or rare some mosquitoes are is furnished by this mosquito. I found the larvae in numbers soon after coming out here in one spot and when that pool dried up as it ultimately did the larvæ died out and I have never once come across a larvæ of this mosquito since though I have searched many likely places. Like L. Alboscutellata this mosquito is easy to identify as it is distinguished by its scutellar scaling from any other species I know of except L. Alboscutellata and from that it is readily separated by the banded hind legs the gold epaulettes on the shoulders and the banded palpi in the male.

Genus 24.—**Geitonomyia.**—NOV. GEN.

Head with narrow-curved scales above, spatulate scales at the sides and upright scales over the whole upper and lateral surfaces. Female palpi four-jointed, male three-jointed and longer than the proboscis the two last joints being hairy as in culex but the joints are shorter than they are in that genus. Thorax with narrow-curved scales. Scutellum with ligulate scales at the base of the middle lobe and on the lateral lobes and narrow-curved scales on the apex of the middle lobe. Wings with broad laterally projecting median scales.

Remarks.—Very like culex differing in the presence of spatulate scales on the scutellum. The first species described here is described in THEOBALD'S "Monograph" under the name of "Culex Caecus" but he remarks that he has only placed it provisionally in the genus culex from which I have now removed it. The name is taken from the Greek Geiton neighbouring and a fly, signifying its close relationship to culex.

Geitonomyia Cæcus.

Culex Cæcus.—*Theobald.*

Head deep brown, clad above with flaxen narrow-curved scales, at the ides with spatulate scales first dark brown then white. Thorax brown ith bronzy scales. Scutellum with curved white scales and some small patulate scales arranged more or less in a row at the base. Wings with ery conspicuous median scales. Legs banded.

Female Head.—Dark brown, the upper surface thinly covered with cattered narrow-curved scales pale flaxen in colour which scales are nassed along the orbital margins and form a golden line; outside there is irst a large spot of dark brown spatulate scales (difficult to see) and then vhite spatulate scales; numerous dark brown upright scales are inserted on he upper surface as far forwards as the vertex. Basal joint of antenna ellowish-brown darker on the inner face and clad with a few very smal lliptical scales, second joint pale at the base, remaining joints dark brown vith dark brown verticils. Clypeus dark brown. Palpi about one-sixth the ength of the proboscis, three-jointed. First joint cyathiform with a constric- ion at its base, second joint pyramidal, third clavate, as long as the other two; here is no nipple-like fourth joint characteristic of the palpi in Culex. The palpi are clad with blackish-brown scales as is the proboscis.

Thorax.—Prothoracic lobes with a nipple-like projection at the lower corner and clad with flaxen narrow-curved scales. Mesonotum dark chestnut-brown with golden-brown scales (bronzy under a hand lens), and creamy scales over the roots of the wings and in front of the base of the scutellum. Scutellum dark brown with flaxen narrow-curved scales and a few white ligulate ones at the base of the central lobe; scutellar bristles dark brown, ten on the central lobe. Pleuræ light and dark brown with patches of white racquet-shaped scales. Wing veins with a double row of dark brown elongated spatulate median scales very conspicuous and lighter brown linear and clavate lateral scales; first fork cell longer and narrower than the second its base a little nearer the base of the wing its stem about as long as the cell; posterior cross-vein rather more than its own length from the median. Coxæ light brown, with dark brown and white scales. Femora clad with dark brown scales, hind silvery beneath; tibiæ with dark purple-brown scales; metatarsi and first two tarsal joints of fore and mid legs with narrow creamy-yellow bands, in the hind legs all the tarsal joints have bands; fore and mid ungues equal and uni-serrate, hind equal and simple.

Abdomen.—Clad above with blackish-brown scales some of the segments having very narrow yellowish apical bands; all segments after the first with large white lateral spots; venter entirely white.

Male.—With a line of flaxen scales in the centre of the head outside these white clavate scales and beyond these white spatulate scales. Antennal joints banded white and light brown; plumes dark brown with pale tips. Palpi longer than the proboscis by their last joint; last two joints short of equal length and beset with long light brown hairs, each joint is clad with blackish-brown scales on its apical two-thirds and white

scales at the base. The penultimate joint is much thicker than the ultimate and is more or less barrel-shaped, there is a broad white band in the centre of the anti-penultimate joint. The mesonotum is lighter brown than in the female and the posterior fourth is clad with white scales. Abdominal segments with well-marked basal bands. Fore and mid ungues unequal the larger unguis toothed.

Occurrence.—Described from a series bred from larvæ in water collected in the pools and ruts in a jungle waggon track at Ulu Klang near Kuala Lumpur.

Remarks.—As the scutellar scaling and the palpi are quite distinct from those of a culex I have no hesitation in placing this mosquito in a separate genus.

Genus 25.—**Theobaldia.**—*Neveu-Lemaire.*

Formerly included in Culex. Not known to occur in Malaya.

Genus 26.—**Lutzia.**—*Theobald.*

Like Theobaldia separated from Culex in which Genus it was formerly included. No species of the genus known to occur in Malaya.

Genus 27.—**Melanoconion.**—*Theobald.*

The species in this genus closely resemble Culex, but the apices of the wing veins are clad with large clavate lateral scales.

Remarks.—Only one species of this genus occurs in Malaya and it presents peculiarities which in my opinion make its position here dou tful. Mr. Theobald classified it from specimens I sent him but the very peculiar male palpi seem to have been overlooked, and the wing scaling is more that of a Culex than a Melanoconion.

Melanoconion Uniformis.—*Theobald.*

A very variable mosquito as to size and colouring. Thorax a dingy washed-out black tinged with green from thoracic contents clad with pale brown scales. Wing scales more linear than clavate and hence resembling the scales of a culex wing rather than that of other members of this genus. Legs and abdomen with dark brown scales. Male palpi about two-thirds the length of the proboscis and of a very peculiar shape.

Female Head.—When fresh of a dark mouse-grey but in the dried specimen if the head is much shrunken it appears dark purple-black. In one specimen I have it is pale fawn-brown. Along either orbital margin there is a line of silvery-white narrow-curved scales the rest of the upper surface is very sparsely clad with golden-brown narrow-curved scales and numerous very long golden-brown upright forked scales ; low down on the sides there is a patch of silvery-grey spatulate scales very difficult to see and not seen at all when one looks directly down upon the upper surface of the head ; vertical bristles very long and dark brown, orbital bristles paler brown. Basal joint of antenna dull brown with darker shading on the inner side where there are a very few small scales, remaining joints dull brown with dark brown verticillate hairs. Clypeus dull brown, pale ochraceous in one specimen. Palpi about one-eighth the length of the proboscis clad with dark brown scales. Proboscis enlarged towards the apex, clad with dark brown scales, purple-bronze in some lights.

Thorax.—Prothoracic lobes almost colourless or dingy-white coloured green with contents, naked except for a few long dark brown bristles. Mesonotum very variable; in one specimen the general colour is dingy-white with dark slate-grey lines and a clothing of pale grey narrow-curved scales and very long dark brown bristles, in another specimen the colour is pale brown with a large dark purple patch on either side behind and the scales are pale tawny and black mixed. Scutellum dirty-white with dark and light narrow-curved scales and dark brown bristles. Pleuræ ochraceous or colourless save for the green tinge from the thoracic contents. Wings differ from other Melanoconions, the lateral scales being linear and not clavate and the scaling does not appear denser at the apex than at the base a feature of the melanoconion wing; first fork cell longer, but not narrower than the second, its base nearer the wing base, its stem less than half the length of the cell; posterior cross-vein about two and half times its own length from the median. Coxæ colourless. Legs except the venter of the hind femora entirely clad with dark purple-brown scales. Ungues equal and simple.

Abdomen.—Clad above with dark brown scales and below the scales are coloured by their background and the venter appears dirty-white or green.

Male.—The head is scaled like that of the female but the silvery orbital margin is broader and the head itself is of a lighter colour. Basal joint of antenna is very large and pale brown in colour, remaining joints pale with dark ridges for the insertion of the verticils; the verticillate hairs are very dense and long and under a hand lens appear dark fawn-brown in colour. The scales on the palpi and proboscis are metallic and a coppery tint. The palpi are about two-thirds the length of the proboscis and of a very unusual shape which cannot be seen in a dried specimen as a rule as they become so distorted, but when fresh in their natural position their shape is as follows: at the immediate base on either side of a very short accuminate clypeus there is an oval swelling which may or may not be separated from the joint following, after this or forming part of it is a long joint the apex of which is enlarged and forms a conical projection on the inner side of the joint on which is inserted a tuft of stiff hairs; the next joint is bent in the form of a bow with the convexity outwards and the articular surface on its apex is set obliquely looking outwards so that the apical joint bends outwards; along the inner side of the apex of the penultimate joint there is a row of short chitinous teeth. I know of no mosquito with palpi anything like those described above and as this mosquito does not in any way resemble the other members of the genus in the scaling of the wing I think its position in this genus rather doubtful but defer to Mr. Theobald who so named specimens I sent him of this mosquito.

Occurrence.—Described from specimens bred from larvæ taken in bamboos and in the water collected in the hollows of trees in the jungle. It is probably entirely sylvan.

Remarks.—Easily distinguished by the head and wing scaling and the peculiar male palpi. In general colour it resembles many other dull-coloured mosquitoes. A description I sent home to Mr. Theobald with

specimens was published in "The Entomologist," but as I recognised some errors in that description I have re-written it and think the present the more accurate one.

Genus 28.—**Culex.**—*Linnæus.*

Head with a large portion of the upper surface clad with scattered narrow-curved scales a small patch of spatulate scales on either side and upright scales over the whole upper surface as far forwards as the vertex and extending on to the lateral surfaces. Thorax and scutellum with narrow-curved scales. Wings with very narrow linear lateral scales.

Remarks.—This unwieldly genus with close on 100 species will probably be further subdivided in the future. There is every justification for seizing upon any constant feature exhibited by several species and creating a new genus, as the present dimensions of the genus makes identification of any particular species no easy matter. I believe a few might be separated off on account of the nature of the scales on the prothoracic lobes. Culex concolor and tigripes and multimaculosus all have spatulate scales on the prothoracic lobes and as they all have carnivorous larvæ and spotted thighs and tibiæ I think they might form a separate genus. I have found such difficulty in identifying the species forming the series with a banded proboscis that I have thought it wiser to withhold description of these until I can compare my specimens with the types in the British Museum. I have simply given a list of those Culicines with banded proboscis at present described from here and have described a few species that seem to me to be new and others about whose identity I have no doubt.

Synoptic Table of Culex.

I. Wings spotted.

* Culex Mimeticus.

II. Wings unspotted.

(A.) Proboscis banded.

* Culex Microannulatus.
* Culex Vishnui.
* Culex Impellens.
* Culex Sitiens.
* Culex Annulus.
* Culex Gnophodes.
* Culex Infula.
* Culex Gelidus.
* Culex Albus.
* Culex Nigricephala.
* Culex Perplexus.
* Culex Loricatus.
* Culex Sepositus.

(B.) Proboscis unbanded.

(*a.*) Legs banded on the tibiæ, tarsi unbanded.

* Culex Univittatus.

(*b.*) Legs with tarsi banded.

* Culex Auratus.

(*c.*) Femora and tibiæ spotted.

* Culex Concolor.
* Culex Multimaculosus.

(*d.*) Legs neither banded nor spotted.

(1.) Abdomen banded.

* Culex Fatigans.
Culex Halifaxii.
Culex Uncus.
Culex Fuscanus.

(2.) Abdomen unbanded.

Culex Longipes.
* Culex Graminis.
* Culex Uniformis.
* Culex Minimus.

(3.) Thorax adorned with golden marginal lines.

* Culex Luteolateralis.

N.B.—Those species against which a star is placed are described here in detail.

Culex Mimeticus.—*Noè* 1899.

Head black with creamy narrow-curved scales and golden vertical bristles. Thorax dark brown with white narrow-curved scales. Costa of wing broken by three white spots. Proboscis banded. Legs banded.

Female Head.—Black, upper part clad with white narrow-curved scales and numerous white upright scales in front and some dark brown ones behind ; on either side low down is a small patch of white spatulate scales ; vertical bristles golden-brown. Basal joint of antenna dark brown with a few small white scales on its inner face, remaining joints dark brown with dark brown verticils. Clypeus deep brown. Palpi clad with black scales. Proboscis clad with blackish-brown scales except in the middle where the scales are creamy and form a band in breadth nearly one-third the total length of the proboscis and two-thirds of which lies to the apical side of the middle point of the proboscis.

Thorax.—Prothoracic lobes almost black clad with creamy narrow-curved scales. Mesonotum dark brown (lighter just in front of the scutellum) clad with white narrow-curved scales and dark brown bristles. Scutellum dark brown with white narrow-curved scales especially thick on the central lobe. Pleuræ translucent and varying in colour according to the contents of thorax, with a patch of silvery scales. Wings clad with dark and creamy-white scales the latter forming spots as follows : three on the costa all involving the first long vein one about the middle of the costa one beyond the junction of the subcosta with the costa and one at the apex ; the second, third, fourth and upper branch of the fifth long veins are white scaled at a point corresponding with the second costal spot and a white band is formed right across the wing at this point ; the lateral scales are linear the median rather broad and clavate ; first fork cell longer than its second, its base nearer the apex of the wing, its stem about half the length of the cell ; posterior cross vein about three times its own length from the median. Coxæ colourless. Legs with deep brown scales with creamy bands at all the articulations except the last two tarsal on fore and mid legs and the last on the hind legs. Ungues equal and simple on all legs.

Abdomen.—With deep brown scales above, with narrow whitish basal bands ; venter white.

Male.—Plumes olive-brown. Palpi ochraceous at the apex and with a narrow creamy band at base of ultimate and penultimate joints and in the centre of antepenultimate joint. Fore and mid ungues unequal each unguis uni-serrate.

Occurrence.—Any muddy roadside pool or pool in marshy ground.

Remarks.—A very distinct culex and the only Malayan species of this genus with spotted wings. The male is here described for the first time.

CULEX MICROANNULATUS.—*Theobald.*

Head black with creamy narrow-curved, numerous deep brown upright, and lateral patches of white spatulate scales. Proboscis banded. Mesonotum black with pale and dark brown narrow-curved scales, and creamy scales in front of the scutellum. Abdomen with well marked white basal bands. Legs banded.

Female Head.—Black, a tuft of white narrow-curved scales on the vertex and scattered creamy narrow-curved scales over the whole upper surface and numerous deep brown upright scales; low down on either side is a patch of white spatulate scales. Basal joint of antenna deep ferruginous with small scales on its inner face, second joint light yellow except at its extreme apex, remaining joints dusky-brown with dark brown verticils. Clypeus ferruginous. Palpi with blackish-brown scales and a few white ones at the apex. Proboscis clad with blackish-brown scales with a broad band of creamy-yellow scales, two-thirds of which band lies to the apical side of the middle line of the proboscis.

Thorax.—Prothoracic lobes black with a few creamy scales above and dark brown ones below. Mesonotum black with dark and light brown scales intermixed and creamy scales in front of the scutellum and over the roots of the wings; lines of dark brown bristles are present and these are especially numerous over the bases of the wings. Scutellum blackish-brown with creamy narrow-curved scales and dark brown bristles ten in number on the central lobe. Pleuræ dark brown with patches of white scales. Wings clad with dark brown scales those on the branches of the second vein being short clavate scales and on the following veins the median scales which are almost piriform project over the lateral scales; first fork cell longer and narrower than the second, its base nearer the apex of the wing, its stem about half as long as the cell; posterior cross-vein rather more than three times its own length from the median. Fore and mid coxae brown with white scales, hind creamy; femora clad with dark brown scales mixed with which are numerous white scales giving the femora a mottled appearance above and laterally; beneath, the femora are entirely clad with silvery scales; tibiæ dark brown on three sides, and silvery on the fourth probably the ventral surface but owing to twisting of the legs in drying it is difficult to say; apices of femora and tibiæ with a narrow creamy-yellow band; base and apex of metatarsi and first two tarsal joints of all legs with narrow creamy-yellow bands. Ungues equal and simple. Pulvilli well developed.

Abdomen.—Deep purple-black above, with a well marked white basal band to all segments after the first; venter with the basal three-quarter of

ıch segment white the apical quarter purple-black. There are also white ıteral spots present.

Male.—Plumes steel-grey. Palpi longer than the proboscis by the ɛngth of the ultimate and half the penultimate joints. Apex of each alpus ochraceous ending in a black spine. There is a narrow creamy and at the base of the ultimate, and penultimate joint, and on the anti- enultimate joint there are two creamy bands a broad one opposite the band n the proboscis and a narrower one between this and the base. The ıorax shows a central line of dark bronzy scales and outside this are lines of aler bronzy scales and outside these dark bronzy scales. The posterior ıird of the mesonotum is chiefly clad with creamy scales. Fore and mid ngues markedly unequal the larger unguis on each foot uni-serrate, the ıaller plain and almost straight.

Occurrence.—Described from a series sent me by Dr. Finlayson from ɔingapore most of which were taken in the house.

Remarks.—The banded proboscis series of culex are difficult to istinguish the one from the other. The positions of the band on the ɔroboscis, the length of the fork cells, the relative position of their bases ɛnd the scaling of the mesonotum are the principal points of distinction.

Culex Vishnui.—*Theobald.*

Head deep brown, densely clad with pale yellow crescentic and upright cales in the centre, outside these on either side is a dark patch due either o dark scales or to the thinning of the scales allowing the dark head to be een, and further out still is a patch of white spatulate with dark brown ıpright scales. The dark patch is well seen under a hand lens but is not o distinct under higher powers. Thorax uniformly clad with golden-brown cales and a line of white ones round the bare space in front of the scutellum. ɔcutellum with white scales. Legs dark brown with a pale band at all the oints except the last tarsal.

Female Head.—Dark brown, in the middle entirely covered with pale ellow crescentic and upright scales, beyond which is a dark patch with a ew pale yellow scales on it and a mass of dark brown upright scales and ɔossibly dark brown spatulate scales also though I cannot be certain whether his black area is due to the absence of scales allowing the head to be seen ɔr to the presence of dark brown scales; beyond this again is a patch of vhite spatulate scales. Basal joint of antenna dark brown with a few small cales on its inner face, remaining joints dark brown with short flaxen hairs ınd dark brown verticils. Palpi dark brown. Proboscis dark brown with ı pale yellow band the greater part of which lies to the apical side of the middle point.

Thorax.—Prothoracic lobes dark brown with flaxen scales; mesonotum lark brown, uniformly clad with bright golden-brown crescentic scales and ı line of white ones surrounding the bare space in front of the scutellum; ɔcutellum dark brown in the middle, ochraceous at the sides, clad with ɔale yellow scales and with eight border bristles to central lobe. Wings vith brown scales of the usual type; fork cells rather long, the base of the irst nearer the wing base than that of the second its stem about half the length

of the cell; posterior cross-vein three times its own length from media Pleurae with dark brown areas and patches of white scales. Coxae of a legs and femora of hind legs silvery, femora of fore and mid legs dark brow with a pale band at the apex; tibiae dark brown with pale apical bands metatarsi and first two tarsal joints of all legs with pale basal band Ungues equal and simple.

Abdomen, dark brown above with pale yellow basal bands slightl convex on their free edges; the band on the second segment is very narro at the sides but projects in the middle.

There are well marked white lateral spots to all segments. On the vent is a central line of white scales in its whole length and on either side th segments are white scaled with a very narrow band of brown scales their apices.

Male.—"Head dark brown, with pale scales and whitish flat ones the sides; antennæ banded black and white with umber-brown plumes palpi banded black and yellow the second joint apically yellow, the thi yellow in the middle, the fourth and fifth narrowly yellow at the base, hai brown. Abdomen narrow with basal bands of whitish scales spreading o laterally on the last few segments. Ungues of the fore legs unequal, bot with a single tooth towards the base that of the smaller one minute a coml like process between; those of the mid similar but more unequal. Wing with first sub-marginal cell longer and narrower than the second posteri its stem less than half the length of the cell; posterior cross-vein nearl twice its length distant from mid. Length 3-4 mm."

The above is from Theobald's "Monograph" as I have no male.

Occurrence.—Described from one female caught in jungle near Kua Lumpur.

Remarks.—Though described in Theobald's "Monograph" I have r described the female here in order to make the book as complete as possibl selecting Theobald's description for Malayan mosquitoes only where I hav no type, e.g., the male of this species. This mosquito resemble C. Microa nulatus but the wing scales on the latter species are much broader than th same scales on C. Vishnui and the band on the proboscis is more central i C. Microannulatus.

Culex Impellens.—*Walker.*

"*Monograph of the Culicidæ.*"—*Theobald.*

"Thorax dark brown, covered with pale golden curved scales. Abdome covered with dusky-brown scales and with basal white bands. Legs brow the mid and hind legs with a pale band involving the tibio-metatarsal joint tarsal banding basal. Bases of the fork-cells nearly level."

"Head with creamy curved scales in front and a patch of flat whit scales at the sides, ochraceous forked upright scales in front, with similarl shaped black ones behind, especially laterally, with pale golden bristles i front. Eyes purplish, with a coppery lustre. Palpi black, with a fe white scales at the tip. Antennæ brown with pale pubescence and brow hairs, basal joint and the base of second joint pale testaceous; probosci black, with a pale band at the base of the apical half."

"Thorax dark brown, covered with pale golden, curved, hair-like scales, scutellum dark brown, with pale curved scales; metanotum dark brown; pleuræ brown, with a patch of pale scales over the mid legs."

"Abdomen covered with dusky purplish-brown scales, each segment with a narrow basal band of dull white scales, and their posterior borders with pallid hairs; venter with pale yellowish scales forming basal bands to the segments."

"Fore legs with a pale knee spot and a yellow spot at the apex of the tibia; mid legs with a pale band at the tibio-metatarsal joint, involving both sides of the joint and traces of basal banding on the first two tarsal joints; hind legs with a pale spot at the end of the femora and base of tibiae, a distinct band on the tibio-metatarsal joint, a small band at the base of the first two tarsi, with a very faint trace on the third."

"Wings with the first sub-marginal cell a little longer and narrower than the second posterior cell, their bases about level; posterior cross-vein nearly three times its length distant from the mid cross-vein."

"Length.—4·5 mm."

"Habitat.—Perak (Wray); N. W. Provinces, India (Giles)."

"Observations.—Described from a single female sent by Mr. Wray. It is closely related to C. sitiens, but can at once be told by the bases of the two fork cells being nearly level, whereas in sitiens that the first sub-marginal is much nearer the base than that of the second posterior. The head ornamentation also differs a little, and the strongly-marked tibio-metatarsal band on the mid and hind legs seems very characteristic."

"I feel sure this is the same as Walker's Culex impellens, described from Makessar in Celebes. All that remains of the type, however, are thorax and wings, and they answer to these specimens. I have only seen a single male."

Culex Sitiens.—*Weidemann.*

Head deep brown clad above, with pale golden-brown narrow scales, at the sides with white spatulate scales and numerous dark brown upright scales on the upper surface. Proboscis banded. Abdomen with narrow basal bands and small white lateral spots. Tarsi basally banded. Wings with large clavate median scales which are very conspicuous on the first and third veins.

Female Head.—Deep brown: the whole upper surface is clad with scattered pale golden-brown narrow-curved and rows of dark brown upright scales; on either side, low down, is a small patch of white spatulate scales. Basal joint of antenna deep umber-brown with a few small scales on its inner face, remaining joints deep brown with dark brown verticillate hairs. Clypeus deep brown. Palpi clad with blackish-brown scales and a few pale ones at the apex. Proboscis with blackish-brown scales and a creamy-yellow band at the base of the apical half.

Thorax.—Prothoracic lobes brown with dark brown and pale golden-brown narrow-curved scales. Mesonotum dark brown rather darker in front than behind clad with coppery and golden-brown narrow-curved scales. The scales on the posterior third are pale golden. Scutellum brown with pale

golden scales and mid lobe with six or seven dark brown bristles. Under a hand lens the anterior two-thirds of the mesonotum is rich coppery-bronze with a dark brown central line. There is no marginal line of pale scales. Pleuræ light yellowish-brown with dark brown spots and these are covered with white scales. Wings clad with brown scales, the median scales being very dark and those on the first, third, fifth and sixth veins under a hand lens very conspicuous. The lateral scales are linear, but towards the apices of the veins narrowly clavate, while the median scales are distinctly clavate and on some of the veins project outwards like lateral scales; first fork cell longer and narrower than the second, its base distinctly nearer the wing base, its stem about quarter the length of the cell; posterior cross about two and a half times its own length from the posterior. Coxæ of fore and mid legs brown, of hind legs creamy; femora creamy beneath, dark brown above; tibiæ blackish-brown with creamy apices; metatarsus and first two tarsal joints of fore and mid legs minutely banded, in the hind legs this banding is hardly evident.

Abdomen.—Blackish-brown with narrow dingy-white basal bands and golden fringes on the free edge of segments; on the apical segments there are small white lateral spots. On the venter the segments are yellow with a few dark scales at the apex of each.

Male.—Antennæ banded dark brown and white. Plumes dark olive-brown, or steel-grey in some lights. Palpi with one narrow white band on the first long joint and a creamy band at the base of the penultimate and and ultimate joints. Abdominal bands broader than in the female occupying nearly one half of the entire segment. Fore and mid ungues unequal the larger unguis toothed. Fork cells shorter than in the female; lateral scales shorter and more distinctly clavate.

Occurrence.—Described from a series some bred from larvæ taken in marshy ground others being adults caught in bungalows.

Remarks.—The description of this mosquito corresponds very closely to that of C. Sitiens in Theobald's "Monograph" and I feel sure I am right in regarding it as the same but many of these Culicines are so much alike that it is extremely difficult to identify them from descriptions alone. The wing scaling seems to me to be one of the greatest points of distinction though Theobald gives little notice of the variations.

Culex Annulus.

From "A Monograph of the Culicidæ of the World."—Theobald.

"Thorax dark brown, with narrow curved pale yellowish scales, nearly white in front of the wings; proboscis with a distinct white to creamy band in the middle; abdomen dark brown; with basal creamy-white bands; venter dull yellowish; legs brown, with narrow basal pale rings to fore and mid tarsi, not so clear in the hind legs; ungues of female equal and simple."

"*Female Head.*—Dark brown, with narrow curved creamy-white scales on the occiput and venter, flat white ones at the sides and numerous rather broad brown upright forked ones behind; eyes deep purplish-black, with silvery reflections and a pale border; antennæ dark brown; palpi almost

black, very scaly, a few dull grey scales at the apex, and a few black bristles at the base; proboscis deep brown, with a broad yellowish-white band rather towards the apical half."

"*Thorax.*—Dark brown, with traces of two paler parallel longitudinal lines, covered with narrow-curved pale golden scales on the sides of the mesonotum (the dorsum denuded in all five specimens), and probably all over it; just in front of the root of the wings the scales are white, and also in front of the scutellum; a few black bristles project over the base of the wings; scutellum pale brown, with eight border-bristles to the median lobe; the lateral lobes with the mamillæ of the bristles very prominent, apparently four on the outer row and three on the inner; metanotum chestnut-brown; pleuræ very pallid, almost grey, with a black spot in the middle and some creamy-white scales."

"*Abdomen.*—Black and shiny when denuded, covered with deep brown scales and with basal bands of creamy scales, the bands swelling out rather in the middle, and in gorged specimens are almost white in colour; first segment with two patches of black scales; posterior border-bristles deep golden-brown; venter mostly covered with dull creamy-white scales, the apical corners of the segments being dark."

"Legs with the coxæ and venter of the femora grey, remainder dark brown, the metatarsi and tarsi with narrow pale yellow bands, chiefly basal, but involving, to some extent, both sides of the joints, last joint in the fore and mid legs unbanded; ungues small, equal and simple."

"Wings with brown scales and brown fringe; the median scales of the veins broadish and long, arranged mostly in a double row, the lateral ones thin, moderately long, and slightly curved at their base; at the apex of the first long vein the broad scales are wider than elsewhere; first sub-marginal cell much longer and a little narrower than the second posterior cell, their bases nearly level; stem of the first sub-marginal about half the length of the cell, stem of the second posterior cell equal to about two-thirds the length of the cell; the two stems nearly equal; mid cross-vein a little nearer the apex of the wing than the supernumerary cross-vein; posterior cross-vein longer than the mid, nearly three times its own length distant from it; sub-costal joins the costal just before the base of the sub-marginal cell; border-scales of the fringe dark brown. Halteres grey at the base upper part of the stem and knob brown."

"Length.—3·5 to 3·8 mm."

"Habitat.—Lamma (Stanley); Tai Po, Pokfulam, Hongkong."

"Time of capture.—October."

"*Observations.*—Described from several females in Dr. Rees's Hongkong collection. It resembles to some extent Culex Vishnui, but is rather darker, and the thoracic ornamentation differs. The posterior cross-vein is very far back, and the hind legs show only traces of banding, whereas the banding is most marked in the posterior legs of Vishnui."

Culex Gnophodes.—*Theobald.*

From "A Monograph of the Culicidæ of the World."—Theobald.

"*Thorax.*—Deep brown, with brown and fawn-coloured scales, the latter forming a curved paler area on each side. Proboscis black, with a small pale median band. Abdomen black, with basal white bands. Legs brown, with a trace of pale banding at the tibio-metatarsal joints, and at the base

of the first two tarsi. Base of the second posterior cell nearer the base of the wing than that of the first sub-marginal."

"Head black, with narrow-curved pale scales and black upright forked ones, flat grey ones at the sides of the head; antennæ brown, basal joint testaceous outside, dark on the inside, base of the second joint testaceous; palpi scaled with black, a few white ones at the apex, clypeus deep brown; proboscis black-scaled, with a median pale band."

"Thorax dark brown, with dark brown, dull pale brown, and fawn-coloured narrow-curved scales, the latter forming an indistinct lateral curved patch about the middle of the mesonotum; scutellum deep brown, with narrow-curved pale scales; metanotum deep brown; pleuræ brown, with three pale patches of scales."

"*Abdomen.*—Black, covered with deep black scales, the second to sixth segments with basal white bands, the seventh with basal white lateral spots, the last with a median basal white spot, the basal segment black, with two patches of black scales, with a few grey ones in the middle; venter black, with basal white bands, testaceous at the base."

"Legs brown; femora pale beneath; the mid and hind legs show a narrow pale tibio-metatarsal band, not seen in the fore legs; the first two tarsi, and, to some extent, the third, with minute basal pale rings, only noticeable in certain lights; ungues equal and simple."

"Wings with typical brown Culex scales, the first sub-marginal cell about the same length, but narrower than the second posterior cell, its base nearer the apex of the wing than that of the second posterior cell, its stem equal to two-thirds the length of the cell; stem of the second posterior cell also about two-thirds the length of the cell; posterior cross-vein twice its own length distant from the mid. Halteres ochraceous, with grey scales on the knob."

"Length.—5·5 mm."

"Habitat.—Dindings, Straits Settlements."

"Time of capture.—November."

"*Observations.*—Described from a single female perfect save for the hind legs, which are partly destroyed. It is closely related to Culex Microannulatus, but can at once be told by the relative positions of the fork-cells and cross-veins, and by the abdominal banding and ornamentation. The specimen was taken at the Rest House at Bruas, Dindings."

Culex Infula.—*Theobald.*

Monograph of "The Culicidæ of the World."—Theobald.

Thorax black with scattered black scales and a few pale golden ones in front. Proboscis with two pale bands. Abdomen dark brown, with apical bands of yellow scales, especially prominent on the apical segments. Legs dark brown; fore and mid metatarsi basally and apically banded yellow, and also apical and basal banding to the tarsi.

Head.—Black, with a few pale golden scales and numerous black upright forked scales; eyes dull silvery; palpi black, thick, with a few pallid hairs at the top; antennæ dark brown; clypeus dark brown; proboscis black, with a pale yellowish band in the middle and a narrow pale band before the apex.

Thorax.—Black, with scattered black scales, a few pale golden ones n front, and with black bristles, especially thick just in front of the roots f the wings, and traces of paler longitudinal lines; scutellum black, vith traces of black scales, slightly testaceous in some lights, with slight t the sides; metanotum pale chestnut-brown; pleuræ brown.

Abdomen.—Covered with dark brown scales, with apical bands of yellow cales, scanty in front, but very pronounced behind; first segment pale ochraceous, with golden hairs; each segment with a border of golden airs posteriorly; ventrally the abdomen is clothed with yellow scales.

Legs.—With yellowish coxæ; femora ochraceous, with thickly scattered lark scales; tibiæ dark scaled, with a few scattered yellow ones; fore and nid metatarsi basally and apically banded with yellow, also the first nd second tarsal joints, the third faintly so, the fourth entirely dark caled; in the hind legs the metatarsi are the same, but the remaining oints are absent. Ungues simple.

Wings.—With a slight yellowish tinge, the veins clothed with brown cales, the lateral ones moderately long; first sub-marginal cell narrower nd longer than the second posterior cell; the posterior cross-vein nearly wice its own length distant from the mid cross-vein all the cross-veins ery faint; the root of the wing is pallid, but has a distinct round dark pot. Halteres with a pale stem and a brownish knob.

Length.—5 mm.

Habitat.—Taiping, Perak, Straits Settlements; (L. Wray, jun., 22nd November and 21st December, 1899).

Observations.—Described from a single specimen sent by Mr. Wray, nfortunately with the hind tarsi gone. It may at once be told from the ther "banded proboscis" species by the small vitta just before the pex of the proboscis, as well as the broader central one, the basal and pical metatarsil and tarsal banding, and the dark round spot at the root of he wings.

Culex Gelidus.—*Theobald.*

Head black with the upper surface clad with brillant snowy-white narrow-curved and upright scales, and, on either side of these, a patch of dark brown spatulate scales and dark brown upright scales. The whole of the mesonotum in front of the wings clad with snowy-white narrow curved scales a tuft of linear scales over the roots of the wings and black scales behind. Proboscis and leg banded. Abdomen with basal ochraceous bands.

Female Head.—Black; the upper surface densely scaled with snowy-white narrow-curved and upright scales, the lateral aspects with dark brown spatulate and upright scales. Basal joint of antenna, reddish-brown with a few small scales on its inner surface, remaining joints brown, with brown verticillate hairs. Palpi clad with dark brown scales. Proboscis with dark brown scales and a creamy-yellowish band at the base of the apical half.

Thorax.—Prothoracic lobes dark brown with narrow-curved scales. Mesonotum light reddish-brown the portion in front of the wings densely scaled with snowy-white narrow-curved scales, the posterior quarter clad with

dark brown narrow-curved scales. Immediately in front of the wing base is a tuft of lanceolate dark brown scales and another tuft of snowy-white linear scales with their free edges serrated. Scutellum pale yellowish-brown with dark brown narrow-curved scales. Pleuræ creamy with three dark brown spots. Wings with dark brown scales the lateral long and slightly clavate the median shorter and markedly clavate; first fork cell longer, and much narrower than the second, its base nearer the wing base, its stem nearly half the length of the cell; posterior cross-vein rather more than its own length from the median. Coxæ creamy; femora ochraceous, lightly clad with dark brown scales above and laterally, and silvery beneath; tibiæ dark brown with a narrow creamy-yellow apical ring, metatarsi and first two tarsal joints of all legs with minute apical and basal bands; ungues simple and equal.

Abdomen.—Dark brown with basal ochraceous band on each segment and each band shows a small triangular projection in its centre.

Male.—Plumes dark fawn-brown. Palpi longer than the proboscis by the two last joints, clad with dark brown scales with a creamy band at base of ultimate and base of penultimate joint. The antipenultimate joint shows a broad creamy band opposite the band on the proboscis and a much narrower band between this and the base.

Occurrence.—Described from a large series some taken in my bungalow and others bred from larvæ taken in small pools in marshy ground.

Remarks.—A very common mosquito and easily recognised by the dense white scaling on the anterior mesonotum. It is common in houses and bites freely. The male apparently has not been described before.

This mosquito is included under the list of those with unbanded proboscis in THEOBALD'S "Monograph."

CULEX ALBUS. N. SP.

Head clad above with snow-white narrow-curved and upright scales, a small patch of dark brown scales beyond these. Thorax deep brown, anterior two-thirds clad with snowy crescentic scales posterior third with a broad central band of snowy scales succeeded on either side by a narrow band of dark brown followed by a narrow band of white scales. Proboscis with a broad median band of white. Wings with deep brown scales, base of first fork cell nearer base of wing than that of the second. A broad band of white on first three tarsal joints of all legs and metatarsal joint of hind legs.

Female Head.—Brown to almost black, the whole upper surface thickly clad with snowy crescentic and upright scales, low down on either side is a very small patch of dark brown spatulate scales outside which are a few white spatulate scales. Palpi clad with dark brown scales with a few white ones at the tip. Antennae absent in specimen. Proboscis clad with dark brown scales and with a broad band of white three-quarters of which band lies to the apical side of the middle point of the proboscis.

Thorax.—Prothoracic lobes deep brown clad with snowy crescentic scales. Mesonotum deep brown; anterior two-thirds clad with snowy-white crescentic scales posterior third with a median band of snowy-white scales and lateral bands of dark brown and white scales; middle lobe

f scutellum clad with snowy-white, lateral lobes with dark brown crescentic cales. Central bristles golden, lateral dark brown. Wings with dark rown linear lateral and broader median scales; first fork cell longer and arrower than the second its stem less than half the length of the ell, its base nearer the wing base than that of the second; posterior cross ein about twice its own length from the median. Pleurae light yellow ith dark brown spots and white elliptical scales. Coxae dark brown with hite scales; fore femora dark brown, mid and hind pale yellow with white cales; tibiae dark brown scaled with a white ring on the hind tibia; ietatarsi and tarsi clad with dark brown scales with a white band on the rst three tarsal joints of all legs and on the metatarsi of hind legs. Jngues equal and simple on all legs.

Occurrence.—Described from one female taken in a bungalow at Kuala umpur.

Remarks.—This mosquito somewhat resembles C. Gelidus but differs i the scaling of the posterior third of the mesonotum which in C. Gelidus entirely clad with black scales. Again in C. Gelidus the bases of the ork cells are level whereas in C. Albus the base of the first cell is decidedly earer the wing base than that of the second, and the lateral scales in . Gelidus are broader than in C. Albus.

Culex Nigricephala. n. sp.

Head coal-black thinly covered with pale brown narrow-curved scales bove, white ones along the orbital margins, and a patch of white spatulate cales on either side; deep brown upright scales are present above, and aterally. Proboscis black with a creamy band at the base of the apical alf. Mesonotum black with white basal bands. Legs black with minute reamy bands.

Female Head.—Coal-black; the upper surface with a few scattered pale rown narrow-curved scales, similar white scales along the orbital margins nd a patch of white spatulate scales on either side; deep brown upright cales are present all over the upper and lateral surfaces. Antennal joints lack with black verticils. Clypeus black. Palpi four-jointed, last joint ammiliform clad with black scales. Proboscis black scaled with a creamy and at the base of apical half.

Thorax.—Prothoracic lobes blackish-brown with dark brown and pale arrow-curved scales. Mesonotum deep purplish-brown with two well-narked lines on the denuded surface in front, clad with golden-brown narrow urved scales and some white ones surrounding the bare space in front of the cutellum. Scutellum dusky with creamy narrow-curved scales and black ristles six to the middle lobe. Pleuræ translucent and smoky. Wings vith deep black scales of the culex type; first fork cell longer than the second, heir bases level, its stem as long as the cell; posterior cross-vien about wo and half times its own length from the median. Coxae smoky with ome dark scales; femora black above and laterally, silvery beneath; tibiae lack with a creamy-yellow ring at the apex of the hind tibia; tarsi black, with inute pale bands at base of metatarsus and first two tarsal joints of all egs; ungues equal and simple on all the legs.

Abdomen.—Black, with white basal bands.

Male.—Antennae black and white with black verticils. Palpi black scaled with a creamy band at base and apex of ultimate, at base of penultimate joint, and two creamy bands on the antipenultimate joint, one corresponding in position to the band on the proboscis. Abdominal bands much broader than in the female.

Occurrence.—Described from specimens bred from larvæ taken from paddy swamps near Batu Gajah by Dr. Daniels.

Remarks.—This is the blackest culex I have seen and I can find no description among those with banded proboscis at all corresponding to it.

Culex Perplexus. n. sp.

Head black with white margin to the eyes, creamy-yellow scales in the centre, at the sides spatulate scales, first dark brown then white. Proboscis broadly banded. Thorax with broad white margin, white scales round the bare space in front of the scutellum, and bright golden scales about the level of junction of anterior and middle thirds, the rest being clad with golden-brown scales (under a hand lens these are coppery-bronze). Legs banded. Lateral wing scales clavate, median very broad and asymmetrical.

Female Head.—Blackish-brown: along the orbital margins there is a line of silvery narrow-curved or lunate scales, in the centre is a broad band of creamy-yellow broad curved scales, on either side of these is a large patch of blackish-brown spatulate scales followed by a patch of similar scales, white in colour. The upright scales are creamy in the middle in front, dark brown behind, and at the sides; vertical bristles golden. Basal joint of antenna deep blackish-brown without scales, remaining joints deep brown with short silvery hairs and dark brown verticillate hairs. Clypeus deep brown. Palpi with blackish-brown scales and a few white ones at the tip. Proboscis clad with black-brown scales, except in the centre where there is a broad creamy-yellow band, in breadth about a quarter the total length of the proboscis. The greater part of this band lies beyond the middle point of the proboscis.

Thorax.—Prothoracic lobes deep brown with golden-brown bristles, and creamy and dark brown and narrow-curved scales. Mesonotum black in the centre, deep brown at the sides, under a hand lens the scaling is as follows: A central line of creamy-yellow scales, a broad margin of similar scales running round the portion in front of the wings, and spreading transversely inwards these scales form two patches at the level of junction of anterior and middle thirds, the portions enclosed by these white scales being clad with bright bronzy scales which form a long oval patch on either side. The bare space at the root of the scutellum is surrounded by silvery scales, and outside these are bright bronze scales. This ornamentation is quite distinct under a hand lens but under higher powers is not so distinct. The scutellum is muddy-brown each lobe is clad with long slightly curved silvery scales. The border bristles are light brown and there are six to the central lobe. Pleurae dingy translucent white, with white scales. Wings heavily clad; on the first fork cell the lateral scales are clavate, on the third vein, the branches of the fourth and fifth, the lateral clavate scales are hidden by the broad almost piriform median scales which project on either side of the vein like lateral scales; first fork cell longer and much narrower than the second, its base nearer the apex of the wing, its stem

nearly half as long as the cell; posterior cross vein about twice its own length from the median. Femora clad with blackish-brown scales, the hind silvery beneath and all with a ring of white scales at the apex; tibiae white at the apices; metatarsus and first tarsal joint of all legs with small creamy basal bands; ungues equal and simple on all legs.

Abdomen.—Blackish-brown above with the merest trace of basal banding, but each segment shows a white spot in the centre at its base and there are white lateral spots. On the venter the segments show broad white basal bands.

Male.—Antennæ banded dark brown and white; plumes dark fawn-brown. Ultimate joint of the palpi with a white apex and a white ring at the base, penultimate joint with a white basal ring, the long hairs on these two joints are black opposite the black scaled portions white on the white parts. Antepenultimate joint with the whole of its under surface snow white, on the upper surface there are black and white scales on the basal two-thirds, black only on the apical third. The basal bands on the abdomen are broad and distinct that on the eighth segment is U-shaped. Fore and mid ungues unequal the larger unguis in each case being uni-serrate.

Occurrence.—Specimens bred from larvae from water in the marshy edges of a lake near Kuala Lumpur.

Remarks.—This species does not accurately correspond to any one of the description of banded proboscis culicinæ. It comes very near to several. Only one or two of this series have a distinct patch of black spatulate scales on the sides of the head. Such a patch occurs in Culex Vishnui but C. Perplexus differs materially from Vishnui in the thoracic ornamentation, the dark almost black basal antennal joint and the broad clavate wing scales. The thoracic ornamentation of C. Corniger seems to resemble this mosquito but differs in the position of the bases of the fork cells and the type of wing scales and also in the number of bristles on the mid lobe of the scutellum. I can only say the identification of these mosquitoes is exceedingly difficult without comparision with the types. It may be I am re-describing a known species but I do not think so.

Culex Loricatus. n. sp.

Head densely clad with silvery crescentic and upright scales above and behind, and laterally with silvery spatulate scales in the midst of which on either side adjacent to the orbital margin is a small patch of dark brown spatulate scales. Thorax deep brown, densely clad with silvery crescentic scales over the anterior three-fourths, with silvery and dark brown scales on the posterior fourth. Wings with light and dark brown scales the median on all veins after the second being very large piriform scales of a deep brown colour and projecting as lateral scales giving the wing a very unusual appearance. First three tarsal joints of all legs with broad creamy basal bands.

Female Head.—Deep brown, thickly covered above with silvery broad crescentic (narrow-curved), and numerous creamy upright scales, upright scales posteriorly and laterally being dark brown; on either side is a patch of white spatulate scales with a few dark brown spatulate scales forming a small spot adjoining the orbital margin. Basal

joint of antenna invisible owing to retraction, remaining joints dark brown. Palpi with dark brown scales except at the tips where there a few grey scales. Basal and apical thirds of the proboscis clad with dark brown middle third with creamy scales.

Thorax.—Prothoracic lobes deep brown with silvery scales above and golden ones below. Mesonotum when denuded, shews a broad band dark purple in colour with a brown band on either side of this and dark purple margin; the anterior three-fourths is thickly covered with silvery crescentic scales, the posterior fourth with silvery scales in the centre surrounding a bare space in front of the scutellum and dark brown scales outside these and over the wing roots. Wings clad with very dark brown median and lighter brown lateral linear scales; the median scales on all veins after the second are very large somewhat piriform in shape and project outward more like lateral scales so that under a hand lens the wing shews a number of dark brown lines giving it a very unusual appearance; base of the first fork cell nearer base of the wing than that of the second its stem less than a third the length of the cell; median cross vein placed to the apical side of the supernumerary, posterior cross vein about two and half times its own length from the median; pleuræ with dark brown spots with patches of white scales. Fore and mid femora dark brown, hind femora silvery except at the apices, remainder of all legs with dark brown scales with broad creamy basal bands on the first three tarsal joints of all legs and on the metatarsal joints of the hind legs.

Abdomen.—Clad with dark brown scales with a triangular patch of dirty white scales at the base of each segment except the last.

Occurrence.—Described from one female taken in a bungalow in Kuala Lumpur.

Remarks.—A very distinct species easily recognized by the peculiar scaling of the wing as no other Malayan banded-proboscis Culex has a wing at all resembling it. The small brown spot on either side of the head in the lateral patch of white is also very characteristic.

Culex Sepositus. n. sp.

Head thickly clad with flaxen scales. Thorax densely clad as far as the bases of the wings with pale flaxen scales which in some lights appear coppery, a tuft of long dark brown scales over each wing root and black scales posteriorly with a line of golden scales surrounding the bare space in front of the scutellum. Proboscis with a creamy band in breadth about quarter the total length and two-thirds of the band lying to the apical side of the middle point. Femora and tibiæ mottled with creamy scales. Tarsal bands on all legs involving both sides of the joint. On the hind legs there is a well-marked band at the base of the metatarsi.

Female Head.—Deep brown to black, upper surface clad with golden crescentic and numerous white upright scales; on either side is a patch of white spatulate scales inserted amongst which are deep brown upright scales which extend on to the occiput behind the white upright scales. Basal antennal joint ochraceous with a few white elliptical scales on its inner face, remaining joints dark brown with dark brown verticils. Palpi clad with dark brown scales. Proboscis with dark brown scales

with a creamy band in breadth about quarter the total length of the proboscis two-thirds of which band lies to the apical side of the median point.

Thorax.—Prothoracic lobes dark brown with flaxen scales above and dark brown ones below. Mesonotum dark brown in the centre and at the margin, orchaceous elsewhere. The portion in front of a line joining the roots of the wings thickly clad with pale crescentic scales which vary with the direction of the light appearing flaxen or coppery; there is a tuft of long dark brown ligulate scales over the root of the wing of either side, a line of golden scales round the bare space in front of the scutellum and dark brown scales between this line and the margin on either side; scutellum ochraceous at the base but dark brown at the apex clad with flaxen and dark brown scales. Pleuræ ochraceous with small patches of white scales. Wings clad with dark brown scales; the second long vein and its branches have linear lateral and short spatulate median scales the third long vein has median and clavate lateral scales while the stem of the fourth has linear lateral scales and its branches small median and very short clavate lateral scales; base of the first fork cell nearer base of wing than that of the second, its stem less than half the length of the cell; posterior cross vein scarcely twice its own length from the median. Femora and tibiæ of fore legs clad with dark brown scales mottled with yellow, hind femora pale except above. First three tarsal joints of all legs with well-marked apical and basal creamy bands and the base of metatarsal joint of hind leg shews a similar band. Ungues equal and simple on all legs.

Abdomen.—Clad with dark brown scales with apical yellowish bands concave forwards, and white lateral spots.

Occurrence.—Described from one female taken in jungle close to Kuala Lumpur.

Remarks.—A very distinct species of this series. The thoracic ornamentation, the presence of dark scales on the scutellum and the peculiar abdominal banding at once distinguish it from any other Culex with a banded proboscis.

Culex Auratus. n. sp.

Head deep purple with golden-yellow narrow-curved scales in the centre and along the orbital margin; outside these on either side is a patch of dark brown succeeded by a patch of deep golden spatulate scales; there are numerous upright scales on the upper surface, those in front being golden-brown, those behind and at the sides dark brown. Thorax deep ferruginous with golden-brown scales. Abdomen with basal golden bands and legs with creamy-yellow basal bands.

Female Head.—Deep purple; along the orbital margins, and above, in the centre, are numerous deep golden-yellow narrow-curved scales, outside these, on either side, is a very distinct patch of deep brown spatulate scales followed by golden spatulate scales; the upright scales are inserted as far forwards as the vertex; in the centre in front they are golden-brown, behind and at the sides they are dark brown; vertical bristles golden-yellow. Basal joint of antenna bright golden-brown with a few small dark brown scales on its inner side, remaining joints black with dark brown verticillate hairs. Palpi and proboscis clad with deep blackish-brown scales.

Thorax.—Prothoracic lobes deep brown clad with golden narrow-curved scales. Mesonotum deep ferruginous, with golden and golden-brown narrow-curved scales. Pleuræ chestnut-brown with creamy scales. Wings with dark brown culex-like scales; first fork cell longer and narrower than the second, its base nearer the apex of the wing, its stem two-thirds the length of the cell; posterior cross-vein about its own length from the median. Coxæ light yellowish-brown; femora with dark brown scales above and laterally, and golden-brown beneath. Knee spots golden-brown and also the tibio-metatarsal articulations especially marked in the hind legs; base of metatarsus, and bases of first three tarsal joints in hind leg, golden-brown, the rest clad with dark brown scales, the front tarsi shewing no banding; ungues large and uni-serrate in front and mid legs.

Abdomen.—Deep brown above, each segment with a well-marked golden basal band, and large creamy lateral spots; venter golden.

Occurrence.—A common jungle variety in some places but very local.

Remarks.—This is one of the largest members of this genus and is a vicious biter and feeds so greedily that at times it can scarcdy fly after gorging itself. I do not know any mosquito capable of such enormous distension as this one. I have no males and have never found the larvæ. There is no other culex I am acquainted with it could be confused with. The leg banding is variable. In one specimen the first tarsal joint of the mid leg has a creamy-yellow band at its base. This mosquito resembles Culex Occidentalis but there is no broad band spatulate black scales on the head and the prothoracic lobes have no broad scales. It also resembles flavifrons but a careful comparison shews points of distinction sufficient to constitute it a separate species.

Culex Concolor.—*Theobald.*

Head with white crescentic scales on the vertex and loosely scattered similar scales spread over the occiput, white scales along the orbital margin and forming lateral patches, deep brown scales elsewhere. Thorax with blackish-brown scales three spots of golden scales in front and two about the centre one on either side. Scutellum pale yellow with creamy scales. Legs much spotted; last three segments of abdomen clad with dull ellow scales.

Female Head.—Black, with a central patch of creamy crescentic scales on the vertex, scattered white ones behind, a row of white scales along either orbital margin, deep blackish-brown spatulate scales on either side and beyond these a small spot of white spatulate scales adjoining the orbital margin on each side, and numerous black upright scales behind at the sides and on the vertex. Basal joint of antenna black with small white scales on its inner face, remaining joints black with black verticils. Palpi rather long clad with dark brown scales mottled with numerous pale yellow ones. Proboscis with a broad median band of yellowish scales and dark brown scales at base and apex.

Thorax.—Prothoracic lobes black with a tuft of pale yellow ligulate scales above and spatulate scales below and numerous dark brown bristles. Mesonotum black clad with almost black crescentic scales and golden ones arranged as follows, a patch in the centre of anterior margin just over the

neck on either side of the middle line a broken line of golden scales forming three distinct linear patches a patch on the margin behind each shoulder and over each wing. Where the mesonotum joins the scutellum it is ochraceous and clad with golden scales. Scutellum ochraceous and clad with dull white scales and dark brown bristles. Pleuræ smoky with patches of dull white scales. Wings long, smoky and clad with short linear scales; fork cells relatively short first longer and narrower than the second its base either level or a little nearer the base of the wing than that of the second; posterior cross vein very near the median being placed a little to the basal side of the latter. Legs without bands clad with deep brown and white scales; femora silvery beneath and mottled-brown and white above and laterally; tibiæ with white scales predominating and scattered brown ones amongst them; tarsi entirely brown, metatarsi brown with scattered white scales. Ungues equal and simple. Abdomen clad with deep brown scales dorsally on segments two-four, segment one with two central spots of black scales fifth segment with narrow apical band of dull yellow scales, a much broader band on the sixth segment and the remaining entirely clad with yellow scales. Venter ochraceous.

Male.—Antennæ with brown plumes. Palpi banded black and yellow longer than the proboscis by the ultimate and part of penultimate joints. Abdomen with larger yellow bands than those of female apical segments entirely yellow as in the female. Fore ungues unequal and uni-serrate.

Occurrence.—Fairly universal in the Malay Peninsula. The larva is found in stagnant pools and small tanks containing stable drainage where other larvae are present generally those of C. Gelidus and Uniformis as few other mosquitoes breed in water containing sewage. The larva feeds entirely on the larvæ of smaller mosquitoes or on its fellow larvæ and in shape and appearance is similar to the larvæ of Toxorhynchites and Ekrinomyia. The adult frequents houses.

Remarks.—A very variable mosquito in respect of its ornamentation but the conspicuous feature is the yellow scaling at the end of the abdomen. The main differences between it and Multimaculosus are the presence of yellow scaling at end of abdomen, shorter wing scales and much darker scaling of head and thorax.

Culex Multimaculosus. n. sp.

Head black with scattered creamy narrow-curved scales and golden-brown upright ones above, creamy spatulate and blackish-brown upright scales at the sides. Proboscis and palpi clad with black scales. Thorax deep blackish-brown, or lighter reddish-brown in some specimens, clad with dark and golden-brown scales. Abdomen unbanded. Legs deep brown with numerous patches of white scales on femora and tibiæ and creamy-yellow bands at femoro-tibial and metatarso-tibial articulations.

Female Head.—Black; the upper surface clad with scattered creamy narrow-curved scales and numerous golden-brown upright scales the sides with pale yellow spatulate and dark brown upright scales; on the vertex is a tuft of golden-brown bristles. Basal joint of antenna dark brown with small creamy scales on its inner face, base of second joint pale yellowish, remaining joints dark brown with dark brown verticils. Palpi clad with dark brown scales and a patch of white ones on the inner side at the base

of the third joint. Clypeus deep brown. Proboscis with deep purple-brown scales and some ochraceous ones beneath about the middle.

Thorax.—Prothoracic lobes deep brown with creamy-yellow narrow-curved scales in some specimens, in others the prothoracic lobes are black and the scales are spatulate. Mesonotum variable, sometimes chestnut-brown, sometimes more purple-brown, and in others deep blackish-brown; round the anterior margin is a band of pale golden scales and on the dorsum are two golden spots one on either side of the middle line about a one-third of the way back; these spots are very plain in some specimens less so in others; the rest of the mesonotum is clad with dark brown and golden-brown narrow-curved scales which, under a hand lens appear bronze-brown. In front of the scutellum the scales may be black, or black and gold mixed, and in some specimens the mesonotum is paler here than in front. Scutellum pale muddy-yellow with pale scales, or dark brown with dark scales. Pleuræ deep brown with patches of white scales. Wings with a yellowish tinge in front, clad with dark brown scales; the lateral scales are long and slightly enlarged towards the apex; the fork cells are rather long, the first a little longer than the second, its base a little nearer the apex of the wing, the stems of the two cells are of about equal length and a little less than half the length of the cells; cross veins almost in a line, the posterior being placed a little to the basal side of the median. Fore and hind coxæ creamy, middle dark brown; fore and mid coxæ clad with dark brown and white scales; femora with a creamy basal ring and creamy spot at the apex, clad with deep brown scales (except the venters of the hind femora which are creamy) and large white spots along their whole length best marked on fore and mid femora; tibiæ mottled with numerous large white spots and with a creamy ring at the apex of each, metatarsi and tarsi deep brown; ungues equal and simple on all the legs.

Abdomen.—Entirely blackish-brown above, ochraceous below; the apical segments shew lateral spots of white scales.

Male.—Basal joint of antennæ light brown, remaining joints banded dark brown and white, plumes dark fawn-brown. Palpi longer than the proboscis (which is much longer than that of the female) by the whole of the last and about a third of the penultimate joint; ultimate joint golden-brown with a few dark scales on its upper surface and a row of long golden-brown hairs on its inner aspect, penultimate joint dark brown above, beneath there is first a patch of snowy-white scales at its base then a patch of dark brown scales and than golden-brown scales to the end. The lateral hairs are very long and golden-brown on the inner side, on its outer side they are shorter and dark brown on the basal half and golden-brown beyond; antipenultimate joint deep brown above. A few white scales are seen on the apex of the eighth abdominal segment dorsally and a large patch laterally. Fore and mid ungues markedly unequal both the smaller and larger on each foot with one tooth.

Occurrence.—Described from specimens caught in the jungle and bred from larvæ taken from small ponds and roadside ditches and in one case a pool in the jungle.

Remarks.—Among my specimens there is considerable variation and I am almost inclined to believe I am describing two species under one name. The variations however are not constant neither are they all present in one

specimen I therefore prefer to treat them as one species calling attention to the variations. This is a very large mosquito and resembles Culex Concolor in many points especially in having a large carnivorous larva which is often found in the same pools with the larva of C. Concolor but is quite distinct from it. It also resembles C. Halifaxii a species taken in "The Dindings." From this it differs in the marked spotting on the femora and tibiæ and the position of the cross veins and the colour of the cephalic upright scales which in most specimens are bright golden-brown and not creamy-grey.

Culex Fatigans.

Head deep brown, with pale golden crescentic scales centrally white scales along the orbital margins, on either side a patch of spatulate scales white near the orbital margin dark brown behind and numerous dark brown upright scales all over. Thorax brown with tawny scales. Abdomen dark brown with well-marked creamy basal bands. Legs dark brown with creamy-yellow knee and ancle spots. Tarsi unbanded.

Female Head.—Dark brown, along the orbital margins is a narrow band of white crescentic scales broadening on either side into a small patch of spatulate scales behind which is a patch of dark brown spatulate scales the whole upper surface is covered with scattered golden crescentic and numerous dark brown upright scales. Basal joint of antennæ ochraceous unscaled, second joint ochraceous at the base, remaining joints dark brown with dark brown verticils. Palpi and proboscis entirely covered with dark brown scales.

Thorax.—Prothoracic lobes dark brown with silvery crescentic scales. Mesonotum light yellowish-brown with two dark brown lines thinly covered with tawny or pale golden scales. Scutellum yellowish with a few pale scales. Number of bristles very variable. Pleuræ translucent and tawny-yellow. Wings with dark brown scales and long fork cells, first fork cell longer than the second its base a trifle nearer the wing base its stem about one-third the length of the cell; posterior cross vein about one-and-half times its own length distant from the median. Legs entirely clad with dark brown scales except on the under and lateral surfaces of the hind femora and at the apices of femora and tibiæ where there are pale rings.

Abdomen.—Dorsally clad with dark brown scales and white basal bands. The venter is entirely scaled with pale yellowish scales.

Male.—Antennæ with silky-brown plumes. Proboscis clad with deep brown scales. Palpi longer than the proboscis by the ultimate and half the penultimate joints clad with brown scales and shewing one narrow white band at the antepenultimate joint at the junction of its basal and middle thirds. Last two joints with long hairs. Abdominal bands broader than those in the female those on the last segments having concave free edges. First fork cell in wing much narrower than the second; posterior cross vein about twice its own length from median. In all other respects the male resembles the female.

Occurrence.—Found in houses all over the Malay Peninsula. The larvæ bred in tins or pots in the neighbourhood of houses or in any little stagnant pool or drain but always in close proximity to houses.

Remarks.—A true night feeder never apparently troublesome during the day, and entirely domestic as it is only found in the neighbourhood of houses. This mosquito and Mansonia Uniformis are the two most troublesome pests in most houses in the evening and through the night but even in this town its distribution is variable and European bungalows in the garden away from native quarters are comparatively free while bungalows near native quarters swarm with this mosquito though in the case of my own bungalow I could not find a single breeding place in the garden or in an adjacent swamp.

Culex Graminis. n. sp.

Head dull blackish-brown with dull tawny narrow-curved scales in the centre spatulate scales along the orbital margins and at the sides and tawny and dark brown upright scales above and at the sides. Thorax dull brown more or less tinged with the colour of the contents. Legs proboscis and abdomen covered with blackish-brown scales without any kind of ornamentation. Pleuræ translucent.

Female Head.—Dull blackish-brown, the upper surface clad with dull tawny narrow-curved scales which occupy a wide area on the nape but as the vertex is approached taper off to a point, at the sides there are spatulate scales which are dull tawny and further out dull white and a row of these scales spreads along the orbital margins right up to the vertex; the upright scales in front are tawny, behind and at the sides deep brown. Basal joint of antenna light brown outside, dark brown on its inner face where a few small dull white scales are inserted, remaining joints deep brown with deep brown verticils. Palpi about one-fifth the length of the proboscis, they and the proboscis are clad with dull blackish-brown scales. Clypeus dark brown.

Thorax.—Prothoracic lobes dull muddy-brown without scales. Mesonotum dull muddy-brown slightly tinged with contents of thorax clad with small narrow-curved scales white on the anterior margin bronze-brown elsewhere. Scutellum similar in colour to the mesonotum clad with dull tawny and dark brown narrow-curved scales; central lobe with ten brown bristles. Pleuræ translucent coloured by the thoracic contents, quite naked. Wings with brown linear lateral scales; fork cells of medium length, of equal breadth the first a little longer than the second, its base nearer the apex of the wing its stem about three-quarters the length of the cell; posterior cross vein a little more than its own length distant from the median. Coxæ colourless; femora deep brown above and at the sides on the fore and mid, silvery beneath, and on the hind laterally; remainder of all legs with deep purple-brown scales. There is absolutely no trace of banding or ornamentation of any kind. Ungues of all legs equal and simple.

Abdomen.—Deep blackish-brown above, each segment with a fringe of ochraceous hairs; the venter is clad with dull creamy scales.

Male.—Antennæ of male banded white and dark brown; plumes deep olive-brown. Palpi longer than the proboscis by rather more than last joint, the last two joints very hairy and about equal in length. Fore and mid ungues unequal the larger unguis on each foot uni-serrate.

Occurrence.—Described from a large series bred from larvæ taken in open bamboos in jungle.

Remarks.—I believe this species is entirely sylvan. I cannot find any description that would appear to be that of this mosquito and have therefore treated it as a new species. In some points notably the scaling of the head it resembles members of the genus Lophoceratomyia but the male antennæ are destitute of any of the peculiar scales present on the Malayan members of that genus.

Culex Uniformis. n. sp.

Head black with scattered white narrow-curved scales above, white spatulate scales at the sides, and dark brown upright scales above and laterally. Thorax brown with three dark purple lines and covered with pale brown narrow-curved scales, with white ones in front of the scutellum. Pleura crossed horizontally by two dark brown lines with a white line between covered with white scales. Legs and abdomen blackish-brown without bands or spots.

Female Head.—Black, the upper surface is clad with white narrow-curved scales which in the centre are set thickly but are more scattered towards the sides, outside these on either side is a patch of white spatulate scales, and above and laterally are numerous rows of dark brown upright scales. Basal joint of antenna dusky-brown, remaining joints black with dark brown verticils. Clypeus deep brown. Palpi with blackish-brown scales. Proboscis towards the base clad with dingy-white scales at the apex the scales are dark brown and white above; the under surface is pale in its whole length.

Thorax.—Prothoracic lobes almost black with white narrow-curved scales. Mesonotum on the anterior margin deep purple and from this patch three dark purple lines run backwards to the scutellum the parts between being muddy-brown becoming paler as the scutellum is approached, in front of which the mesonotum is dingy-white. There is a purple patch on either side above the wings. The scales on the anterior margin and in front of the scutellum are white elsewhere bronzy or tawny. Scutellum dingy-white with white narrow-curved scales. Where the pleura meets the mesonotum there is a dark brown horizontal line unscaled beneath this is a white line covered with white scales and below another dark brown line. Wings smoky clad with typical culex-like scales; first fork cell longer and narrower than the second, their bases level, its stem about one-third the length of the cell; posterior cross vein about two-and-half times its own length from median. Coxæ colourless and translucent; fore and mid femora dark brown above silvery beneath; hind femora almost entirely clad with silvery scales; remainder of all legs clad with black scales. Ungues simple and equal.

Abdomen.—Deep blackish-brown above, white below; apical segments with white patches.

Occurrence.—Described from two females taken in marshy ground near Batu Gajah.

Remarks.—This species comes very close to Culex Viridis but differs as follows: The head is black not brown and the scales on it are pure white not grey the upright scales being black and not pale brown. The under side of proboscis is pale; there are eight to ten border bristles on the central lobe of scutellum; the metanotum is pale creamy and not brown;

there are no apical dark bands on the venter of the abdomen. The very characteristic pleural ornamentation in this mosquito is not present in C. Viridis. The most marked feature of this mosquito is undoubtedly the pleural markings namely the creamy line covered with white scales flanked on either side by a dark brown unscaled line.

Culex Minimus. n. sp.

Head blackish-brown with snowy-white narrow-curved scales above, snowy-white spatulate scales at the sides, and dark brown upright scales all over. Palpi and proboscis brown. Mesonotum muddy-brown with a few white narrow-curved scales on the anterior margin and in front of the scutellum and tawny scales on the dorsum. Scutellum with white scales. Wings with typical culex scales. Pleuræ ochraceous. Abdomen pale muddy-white with brownish scales. Legs unbanded.

Female Head.—Black, clad above with scattered white narrow-curved scales, at the sides with white spatulate scales, and among the scales above and laterally are numerous dark brown upright scales. Basal joints of antenna brown without scales, remaining joints dusky with dark brown verticils. Clypeus deep brown. Palpi and proboscis dull brown.

Thorax.—Prothoracic lobes brown with creamy narrow-curved scales. Mesonotum dark brown in the centre, pale muddy-brown at the sides and in front of the scutellum, clad with tawny narrow scales, a narrow band of white ones round the anterior margin and white scales in front of the scutellum. Scutellum pale muddy-brown with white narrow-curved scales and dark brown bristles of which there are five on the central lobe. Pleuræ creamy with two brown lines crossing it horizontally and a line of white elliptical scales between these. Wings with typical culex scales the lateral long and very narrow with square ends, fork cells moderately long the first longer and narrower than the second, its base nearer the wing base, its stem about one-third the length of the cell, posterior cross-vein rather more than its own length from the median. Coxæ trochanters and bases of femora creamy. Legs clad with brown scales which in some lights are coppery. Ungues equal and simple.

Abdomen.—Dusky-brown above, and pale creamy below.

Male.—Antennæ with pale fawn-brown plumes. Palpi longer than the proboscis by their last two joints, pale muddy-brown with dusky scales; the last two joints with lateral rows of long hairs. Fore and mid ungues unequal and both ungues on both feet uni-serrate.

Occurrence.—Described from a series bred from larvae taken from water in mud holes in swampy land in Kuala Lumpur.

Remarks.—This is the smallest Culex out here and one of the dullest-coloured. It is absolutely destitute of any ornamentation.

Culex Luteolateralis.—*Theobald.*

Head with a large gold spot above. Thorax with a broad band of, dark golden scales on either lateral margin which unite anteriorly and a narrow line of the same coloured scales on either side of the middle line, rest of the thorax clad with purple-bronze scales. Legs unbanded. Abdomen basally banded white.

Female Head.—Black; a tuft of long linear golden scales on the vertex and projecting forwards, behind this a round area covered with narrow-curved golden scales and golden upright forked scales. This patch extends back to the occipital foramen but laterally is sharply defined by a patch of broad flat black scales on either side. On the orbital margin in the midst of these black scales there is a very small spot of golden scales. Orbital bristles dark brown.

Basal joint of antenna brown looks black when dry, naked, second joint brown at the base with a very few small black scales inserted on it, black apically, remaining joints black with silvery-white tomentum. Verticillate hairs black with pale tips. Clypeus dark brown and nude. Palpi about one-fifth the length of the proboscis scaled with dark brown scales almost black under a 2/3. Proboscis scaled as the palpi.

Thorax.—Prothoracic lobes dark brown under a hand lens, under a 2/3 or when dry they look black, beset with numerous dark brown bristles but without scales. Thorax chestnut-brown or purplish-brown varying with the amount of light; on either side from above the root of the wing a broad band of narrow scales of the colour known as old-gold runs forwards to the anterior margin converging until they almost meet and at this point they are united by a small patch of similar scales. The space between these lines is clad with bronzy scales which have a purple hue in some lights and two more or less perfect lines of golden scales traverse the length of the mesonotum on either side of the middle line. In some specimens these lines are only seen on the posterior half in front of the scutellum. Alar and præscutellar bristles golden. Scutellum similar in colour to thorax clad thinly with golden narrow-curved scales. Pleuræ dark brown under a hand lens, under a 2/3 unless the light is good, black, inserted on each are several tufts of dark brown bristles and five patches of scales each patch consisting of only about four or five scales; two of the patches are narrow-curved scales and dark gold in colour two are small spatulate-shaped scales, and one over the middle coxa consists of elongated scales with truncated ends. Wings, except the base of the first long vein and the greater part of the fifth vein, which are golden scaled, clad with dark brown scales of the culex type, the lateral being bluntly lanceolate, or linear, the median narrow spatulate; first fork cell longer and a little narrower than second, their bases about on a level, stem of first cell about half as long as the cell; supernumerary and median veins almost in a line, posterior cross vein about its own length from median. Coxæ dark with dark purple-brown scales and bristles; femora and tibiæ covered with dark brown scales mingled with which are numerous golden scales giving the thighs a mottled appearance; the metatarsus and tarsus scaled dark purple-brown though the scales are almost coppery-bronze in some lights; fore and mid ungues equal and uni-serrate.

Abdomen.—Dorsally clad with scales which are now dark brown now rich purple according as the position to the light is changed. In some specimens the purple is very evident. At the base of each segment is a square patch of creamy scales which does not extend to the lateral margins and hence cannot said to be a band and there are numerous pale golden hairs inserted on the posterior margin of each segment. There are a few scattered pale scales on some of the segments laterally but one could not

speak of them as lateral spots; ventrally the scaling is dark with scattered pale scales. The two last abdominal segments are unusually long and tapering, giving the abdomen a pointed appearance.

Male Head.—Black; on either side of the middle there is a patch of pale golden narrow-curved scales outside these a patch of small spatulate scales dark purple in colour and more laterally still close to the orbital margin of either side is a small round patch of pale golden spatulate scales. Basal joint of antenna very large, and inserted so that its upper end looks outwards rather that forwards, as is usual, it is black in colour and destitute of scales, remaining joints black, with white rings at the insertions of the verticils, last two joints quite black and much elongated; plumes dark steel-grey. Palpi longer by their last two joints than the proboscis clad with dark purple-black scales. The two last joints are turned upwards and bear a row of long silky-grey hairs on either lateral margin. Prothoracic lobes black and naked. Thorax black with a broad band of golden scales on either margin and a few scattered black narrow scales on the dorsum. On the posterior half on either side of the middle line is a very ill-defined line of pale golden scales. Scutellum black with a few pale golden narrow curved scales on the central lobe and black narrow curved scales on the lateral lobe. There are five pale scutellar bristles on the central lobe. Pleuræ black. Wings lightly clad with a few dark brown scales the lateral being short linear scales the median much the same shape but shorter. First fork cell much narrower and but little longer than the second its base nearer the apex of the wing than the base of the latter; posterior cross-vein three times its own length from the median. Legs entirely black scaled without bands or spots. Fore and mid ungues unequal the larger unguis uni-serrate.

Abdomen.—Black with dirty-white basal bands to the segments. Clasper short with a broad spoon-shaped end fringed with long hairs.

Occurrence.—Larvæ taken in small pool in the grounds of the Institute of Medical Research and from the margin of a lake in the Batu Road. Adults have been taken close to the breeding places of the larvae and in other places near Kuala Lumpur and elsewhere.

Remarks.—This mosquito is easily recognised by the broad golden lines on either margin of the mesonotum and the bright golden patch of scales on the head in the centre. It is evidently the same as that described under the name given and the fusing of the two last joints of the male palpi is quite evident and is peculiar to this mosquito among the Malayan species. I agree with Mr. Theobald that it is not rightly placed in this genus as it shews many points of distinction from other members. The larva is distinctly typical and looks more that of an Aioretomyia or Stegomyia. The eggs also are of the Stegomyia type.

Genus 29.—**Gilesia**.—*Theobald.*

Genus 30.—**Grabhamia**.—*Theobald.*

Genus 31.—**Lasioconops**.—*Theobald.*

No species of any one of the above genera have so far been found in the Malay Peninsula.

Genus 32.—**Taeniorhyncus**.—*Arribalzaga.*

Head with greater part of upper surface clad with narrow-curved and ong upright scales, the spatulate scales being confined to a small area on ither side. Proboscis banded; male palpi much longer than the proboscis nd the last two joints with lateral rows of long hairs as in Culex. Thorax nd scutellum with narrow-curved scales. Wings with large scales the ateral either long and fusiform or broad clavate elliptical or asymmetrical.

Remarks.—Six species are here described one of which T. Domesticus s certainly new. They form two very natural groups the first three being range and gold and purple the next three brown and golden-brown. The mportant generic character is the shape of the wing scales for in the palpi ephalic and scutellar scaling they come close to Culex but the wings are lad with scales quite unlike anything seen in Culex. They are apparently nore or less domestic as I have taken all the specimens in houses and some of hem are fairly common. I have only obtained the larva of one species and t is of a very distinct type while the respiratory tubes of the pupa are quite nlike those seen in any other pupæ I have seen, the opening being very blique and broad, the first portion of the tube is small and projects verti- ally upwards then bends forwards at right angles forming a broad oval portion which projects horizontally forwards in front of the cephalo-thorax.

Synoptic Table of Species.

A. Mesonotum bright orange or yellow. General colouration gold and purple.

(*a.*) Thorax orange, legs purple.....T. Brevicellulus.

(*b.*) Thorax bright yellow with golden scales. Legs mostly yellow with purple spots.....T. Ochraceous.

(*c.*) Thorax yellowish-brown with dark brown spots; legs golden with black patches.....T. Conopas.

B. Mesonotum black. General colour brown mottled with white or yellow.

(*a.*) Anterior mesonotom with pale scales. Wing scales of uniform colour.....T. Tenax.

Wing scales dark brown and pale yellow.....T. Ager.

(*b.*) Anterior mesonotum black scaled.....T. Domesticus.

Taeniorhyncus Brevicellulus.—*Theobald.*

Head purple with golden narrow-curved scales and golden-brown upright scales. Proboscis rich rose-purple. Thorax orange-red with dark brown shoulder patches. Legs purple. Abdomen purple banded with gold.

Female Head.—Orange-red behind, dark purple in front and at the sides, clad with scattered pale golden narrow-curved and numerous long golden-brown upright scales on the upper surface and a patch of golden spatulate scales on either side; vertical and orbital bristles bright golden. Basal and second joints of antenna orange and without scales, remaining joints rich purple with purple verticillate hairs. Palpi orange-red with purple scales, five-jointed. Proboscis clad with purple scales which at the base allow the orange background to shew through.

Thorax.—Prothoracic lobes bright orange-brown with golden-brown bristles only. Mesonotum bright orange-red with a large dark patch in

front on either shoulder, thinly clad with bright golden narrow-curved scales and dark brown bristles. Scutellum similar in colour to the mesonotum. Every one of my specimens is destitute of scales and as they are very perfect in other respects it is difficult to believe the scutellum has been denuded a fact which inclines me to the belief the scutellum is not scaled. The bristles on each lobe are four in number those on the middle lobe being in pairs with a space between. Pleuræ orange-red with patches of purple and on these are silvery spatulate scales. Wings with dull brown scales which, where massed as on the costa, become purple; the lateral scales are blunt-ended spindles in shape though some of them on the bases of the veins have obliquely truncated ends and this is the shape of median scales where present; on the third vein the lateral scales are narrower and more lanceolate in shape; first fork cell scarcely longer than the second its base much nearer the apex of the wing its stem as long as the cell; posterior cross-vein about one-and-half times its own length from the median. Coxæ and bases of femora bright ochraceous the remainder of all legs being clad with rich purple scales.

Abdomen.—Clad with purple scales above and each segment with a basal band of golden scales which on the apical segments broaden out laterally. The amount of this banding varies in different specimens and in one the last two segments are entirely golden scaled. The venter is entirely clad with golden scales which become in a dry specimen more of a golden-brown. On one specimen there is a band of creamy scales on the hind femora beneath.

Male.—Palpi clad with dark umber-brown scales and long hairs on the two last joints. They are longer than the proboscis by rather more than the length of the last joint. The ultimate joint is very short less than half the length of the penultimate; both joints are clad with long hairs. The proboscis is the same colour as the palpi. Antennæ densely plumose the plumes being dark umber-brown in some light, lighter brown in others. The thorax is more ochraceous and not such a bright orange-red as in the female. The end of the abdomen is very hairy the fringe of hairs on the venter of the eight segment being remarkably long and dense. The fore and mid ungues are markedly unequal and the larger unguis bears a large tooth.

Occurrence.—Described from a large series taken in my own bungalow in Kuala Lumpur.

Remarks.—Although in one or two minor points such as the colour of the thorax my types shew slight differences from the description in Theobald. I think there can be no doubt as to their identity. I have one specimen in which the whole thorax is dark brown shewing that this colour may vary but the majority of my specimens shew the bright orange thorax I have described. It is a fairly common mosquito in my bungalow and I have one specimen sent by Dr. Finlayson from Singapore. The male is not described in Theobald's "Monograph."

Taeniorhyncus Ochraceous.—*Theobald.*

Thorax golden-brown with brilliant metallic-golden scales. Proboscis, legs and abdomen light golden-brown with a patch of purple scales on the apices of femora and tibiæ.

Female Head.—Bright golden-brown, with metallic-golden narrow-urved scales above, and a small patch on either side of golden spatulate cales; numerous light golden-brown upright scales over the whole upper urface of head. Basal joint of antenna light golden-brown, base of second oint golden-brown, apex of this and the whole of remaining joints, black ith dark brown verticillate hairs. Clypeus golden-brown. Palpi with olden-brown scales and some black ones at the base and apex. Proboscis olden-brown with black labellæ.

Thorax.—Prothoracic lobes golden-brown with golden-brown bristles. Mesonotum golden-brown with lines of deep metallic-golden scales. Scutel-um similar in colour and scaling to mesonotum; central bristles, five long nd one short. Pleuræ golden-brown with two small dark brown spots nd a patch of rather long spatulate scales which are white but look yellowish eing coloured by their background. Wings golden-brown clad with aler golden scales which on some of the veins are lanceolate but on the nterior veins are clavate with obliquely truncated ends; fork cells noderately long, the first longer but no narrower than the second, its base bout level with the second, its stem less than half the length of the cell; osterior cross-vein distant a trifle more than its own length from the nedian. Coxæ and femora golden-brown with a sprinkling of black scales n the anterior face of the femora most numerous on the mid femora. The hind femora also shew a ring of black scales immediately before their pex; tibiæ of fore and mid legs with black scales predominating; hind ibiæ golden-brown with a broad black band at the apex of each; fore arsi mostly black scaled, mid and hind with black and yellow scales. Ungues large but equal and simple. Empodium well developed.

Abdomen.—Clad with golden scales at the bases of the segments and larker golden-brown scales at the apices.

Male.—Palpi longer than the proboscis by the length of about half the ast joint; two last joints about equal in length; the ultimate joint is dark rown and clad with a very few dark brown scales and numerous long lark brown hairs; the penultimate joint is dark brown at the apex but aler yellowish-brown at its base, it is thinly covered with dark brown cales and a dense tuft of golden-brown hairs is inserted at its base and at he apex and between these are dark brown hairs; the antepenultimate oint is bright golden-yellow with golden-yellow scales except at its extreme pex where it is dark brown and bears a few dark brown scales and a dense tuft f long golden-brown hairs. The antennal joints are light purple and the plumes re golden at their base and darker brown at the apices of the hairs. The proboscis is very long enlarged at the end and shews a ridge as though it were jointed. The labellæ are black. The claspers are dark brown of a very peculiar shape. The basal half is slightly curved and in transverse section roughly circular, where the apical half joins it there is a distinct knee or sharp angle and the apical half is much thicker and on each of its surfaces shews a longitudinal ridge which ends in the triangular apex. Fore and mid ungues markedly unequal the larger with one tooth.

Occurrence.—Described from specimens taken in my own bungalow and one taken by Dr. Milne in his bungalow at Kuala Lumpur.

Remarks.—There is no other Malayan species this could be mistaken for. It is the most entirely yellow mosquito of any I know and should be easily

recognised. I know nothing as to its habits except that it is to be found in houses. Dr. MILNE tells me he has taken one feeding on himself. It frequents low herbage in the neighbourhood of houses and swamps during the day.

TAENIORHYNCUS CONOPAS.—*Frauenfeld.*

Thorax light brown with two broad deep blackish-brown lines on the anterior half and on either side behind a large round and a larger oval spot deep brown in colour. Proboscis golden-brown. Legs golden-brown with bands of deep blackish-brown. Abdomen purple with golden-brown bands.

Female Head.—Ferruginous with long hair-like curved bright golden scales on the upper part and low down on the side a patch of small spatulate golden scales; golden-brown upright scales are inserted all over the upper part as far forwards as the vertex. Basal joint of antenna golden-brown with a few dark brown scales on its inner face, remaining joints lost. Clypeus golden-brown. Palpi clad with golden-brown scales mottled with a few scattered black ones. Proboscis golden-brown with golden-brown scales and a few black scales on the under side of the base and a ring of the same at the apex.

Thorax.—Prothoracic lobes golden-brown. Mesonotum brown with two broad blackish-brown lines one on either side of the middle on the anterior half; on either side of the posterior half close to the margin are two large blackish-brown spots the front one round the hinder one oval. The whole mesonotum is clad with deep golden-yellow narrow-curved scales, arranged in lines, and lines of dark brown bristles. Scutellum golden in the middle blackish-brown laterally, without scales. Bristles golden-brown four to the central lobe arranged in pairs with a space between. Pleuræ golden-brown with two horizontal lines of three spots each blackish-brown in colour, and with lines of golden bristles and patches of long clavate golden scales. Wings golden-brown with golden-brown scales on the costa and first vein, dull brown scales on the other veins; these scales are long broad scales with obliquely truncated ends; fork cells of nearly equal length and breadth the base of the first a little nearer the apex of the wing than the base of the second the stem of the first less than half the length of the cell; posterior cross-vien about one-and-half times its own length from the median. Coxæ golden-brown each with dark-brown spot. Femora clad with golden-brown scales a few scattered black ones and a ring of black scales at the apex of each; fore and mid tibiæ mottled with golden-brown and purple scales the purple predominating; hind tibiæ with a ring of purple-black scales at base and apex golden-brown scales between; fore and mid metatarsi and tarsal joints with golden-brown scaling except for a ring of purple-black scales at the apex of each. Metatarsus of hind leg golden-brown scaled on the basal three-quarter, black scaled on the apical quarter; tarsal joints golden-brown on their basal half, purple-black on the apical half.

Abdomen.—Each segment golden-brown at the base and sides, purple at the apex. The purple scaling is deeper in the middle than the sides and thus forms a band of triangular shape the apex of which is directed forwards. Venter invisible owing to retraction. Male uncommon.

Occurrence.—Described from one female taken in Klang jungle.

Remarks.—A very distinct and easily recognised species. The peculiar blackish-brown spots and lines on the thorax give it a very characteristic appearance. The first specimen of this mosquito appears to have been sent by Dr. Wray of Perak to the British Museum. Mr. Butler stated it was fairly common in Klang jungle but I only obtained one specimen there. Rare specimens have also been found on the East Coast.

Taeniorhyncus Tenax.—*Theobald.*

Head black with golden vertical bristles, creamy narrow scales, white spatulate scales laterally, ochraceous upright scales in front, dark brown one behind. Proboscis black scaled with a broad creamy band occupying almost one-third of the total length. Thorax with golden-brown scales on the anterior two-thirds, pale and dark brown scales posteriorly. Leg bands involving both sides of the joints. Abdominal bands apical and basal.

Female Head.—Black, upper surface with scattered creamy narrow-curved scales, lateral aspects with flat white spatulate scales, upright scales in front and in the centre creamy, with a slight yellowish tinge at the sides, and behind dark brown. Vertical bristles golden. Basal joint of antenna brown on its outer side nearly black on the inner face with small white scales, remaining joints blackish-brown with dark brown verticils. Clypeus deep brown. Palpi with blackish-brown scales and white ones at the tip. Proboscis with black scales except in the middle which is clad with creamy-yellow scales. This band is very broad and almost equal to one-third of the total length of the proboscis.

Thorax.—Prothoracic lobes deep brown with creamy-yellow narrow-curved scales above and dark brown ones below. Mesonotum dark chestnut-brown; its anterior two-thirds clad with creamy and flaxen narrow-curved scales, the posterior third with creamy scales surrounding the bare space in front of the scutellum, and dark brown scales at the sides; scutellum dark brown with dark brown and creamy scales and dark brown bristles, there being eight such on the mid lobe. Pleurae dark brown in the centre and light yellowish-brown behind, with patches of white scales. Wings with dark brown scales, the lateral long linear scales with rounded ends the median shorter broader and projecting laterally over the other scales, first fork cell longer than the second its base nearer the apex of the wing, its stem nearly half as long as the cell; posterior cross vein about twice its own length from the median. Fore and hind coxæ light yellowish-brown the fore with dark brown and white scales, mid coxæ dark brown with white scales; femora with deep brown scales purple in some lights and a narrow apical ring of golden-yellow scales; tibiæ with deep brown and scattered golden scales, hind tibiæ swollen at the apex and with golden-yellow scales; metatarsi and first three tarsal joints of fore and mid legs with narrow basal bands, hind metatarsi with broad basal band and a fairly broad basal band on all the tarsal joints. To some extent both sides of the joints are involved. Ungues equal and simple on all legs.

Abdomen.—First segment yellowish-brown with central tuft of dark brown scales, remaining segments with deep purple-brown scales and a narrow apical and basil band of golden-brown scales. Venter white scaled with spots of black scales on the apex of the terminal segments. White lateral patches are present on most of the segments.

Occurrence.—Described from one female taken in my bungalow at Kuala Lumpur.

Remarks.—In most respects this specimen resembles T. Tenax but there are variations.

TAENIORHYNCUS AGER.—*Giles.*

Head deep purple with creamy narrow-curved and upright forked scales. Thorax almost black with creamy and coppery narrow scales in front and black scales behind. Abdomen broadly banded with dingy creamy scales with a greenish tinge. Wings much mottled with dark brown and golden-brown broad scales many with obliquely truncated ends. Legs banded.

Female Head.—Deep purple, clad on upper surface with scattered creamy narrow-curved scales, at the sides with creamy spatulate scales; all over the upper surface there are rows of upright scales the front rows creamy, the hind dark brown, vertical bristles golden-brown, Basal joint of antenna deep brown with a few pale scales on the inner side, remaining joints dark brown with brown verticillate hairs. Palpi clad with deep brown scales and pale yellow ones on the apex. Proboscis black scaled at base and apex, and creamy-yellow in the middle.

Thorax.—Prothoracic lobes deep purple with golden-brown narrow-curved scales above, dark brown below. Mesonotum black the anterior two-thirds, clad with narrow-curved scales golden and golden-brown in colour, posterior third with black scales at the sides and some creamy ones in the centre round a bare space at base of scutellum. Scutellum black with deep brown narrow scales and a few creamy ones intermixed. Pleuræ deep brown with patches of white scales. Wings mottled with dark brown and pale yellow scales; at the apex of the wings the scales are large clavate or almost piriform scales, many of them have obliquely truncated ends, on the fifth vein they are all of this shape; the light coloured scales are about as numerous as the dark. Coxæ dark brown with white scales; each femur has a narrow basal ring of pure white scales and is entirely white scaled beneath and in the hind femora at the sides, but above on the hind, and above, and laterally on the fore and mid femora, the scaling is dark brown mingled with numerous white scales. The tibiæ are as much mottled as the femora and have four rows of short golden spines and a narrow creamy apical ring; the metatarsi and first three tarsal joints of all legs have narrow creamy basal and apical bands, in the hind legs the last tarsal joint has a minute basal band. Ungues simple and equal, empodium large.

Abdomen.—Deep brownish-black each segment with a broad apical band of dingy yellow with a slight greenish tinge. These bands are enlarged laterally and the free edge is therefore concave. The venter is dingy white.

Male.—Antennæ with plumes steel-grey or fawn-brown according to the direction of the light. Palpi longer than the proboscis by the two last joints; ultimate joint with the apical half golden-brown with golden hairs, basal half almost black with black scales and hairs, and a narrow creamy-yellow band at its immediate base, penultimate joint black with a basal golden-brown band and black hairs, antepenultimate joint black, with

a narrow creamy band at junction of basal and middle thirds and a broad yellowish band opposite the band on the proboscis. Abdominal segments with broad apical bands and in some specimens basal bands as well; eighth segment with golden scales except for a small square black patch in the centre. Ungues of fore legs unequal and both toothed, of mid legs unequal the larger with the tooth the smaller cannot be seen, hind equal and simple.

Occurrence.—Described from a large series bred from larvæ taken in water at the marshy edges of lakes and entangled in floating green weed at the sides of a running stream.

Remarks.—This is a very distinct Taeniorhyncus the very broad piriform and asymmetrical wing scales of two colours in equal proportions distinguishing it from the other Taeniorhynci of the brown series here described. In THEOBALD only the male of this species is described and the description agrees with my type except in one point: the apical joint of the male palp is said to be yellow whereas in my specimens it is only the apical half of the the ultimate joint that is yellow and I cannot help thinking there is a slight error as the palpi are figured with four joints and I cannot find any taeniorhyncus with more than three; there is a very abrupt transition of colour in the apical joint and it may be that THEOBALD has taken the two halves of the ultimate as two separate joints in which case the ultimate joint would be yellow. All the brown Taeinorhynci have the two halves of the ultimate joint of different colours but it is only one joint. If there were three joints of about equal size at the end of the male palp it would be such a very unusual condition as to justify very special attention. All the male palpi of these species, like the palpi in culex, consist of a long antepenultimate joint with two hairy terminal joints. GILES description is too short to aid in a decision except for the remarks concerning the wing it would do equally well for any one of three species. In GILES' description special attention is called to the fact of the wing being clad with scales of two colours in equal proportion and this point is well shewn in all my specimens and GILES says it is peculiar to this species.

TÆNIORHYNCUS DOMESTICUS. N. SP.

Head black with pale golden-brown narrow-curved and black upright forked scales. Proboscis with a broad creamy-yellow band. Thorax black or deep brown with pale golden-brown scales, and black ones behind. Abdomen with the last three or four segments with yellow apical bands in some the last two segments may be entirely golden-brown.

Female Head.—Black, upper surface thinly clad with pale golden-brown narrow-curved scales and rows of black upright scales; on either side low down there is a small patch of white spatulate scales; vertical bristles golden-brown. Basal joint of antenna deep ferruginous and without scales, remaining joints dark brown, pale at the insertion of the verticils. Clypeus almost black. Palpi black scaled with a few white scales at the apex, and sometimes a few pale scales at the base. Proboscis with a band of creamy-yellow scales in breadth about one-fourth the total length of the proboscis; the greater portion of this band lies beyond the middle point of the proboscis.

Thorax.—Prothoracic lobes black with golden-brown narrow-curved scales above, and black ones below with a line of black bristles on the

anterior face. Mesonotum black in some specimens, in others deep brown; the anterior three-fourths is clad with blackish-brown, and golden-brown narrow-curved scales the latter arranged in three distinct lines, one central, and one on either side; posterior fourth clad with black narrow-curved scales. Scutellum brown, all three lobes with black narrow-curved scales, and on the apex of the middle lobe are a few hair-like golden scales; bristles dark brown, there being twelve to the central lobe. Pleuræ brown with silvery scales. Wings with dark brown and pale yellow scales; the lateral scales on the veins of the first fork cell are long clavate scales for the most part, but near the apex of these veins some are much broader and some have oblique ends; on the third vein there are lanceolate scales and on its apical half some broad piriform scales, and others quite as broad but oblique ended. There are similar scales on the veins of the second cell and the branches of the fifth vein; fork cells long, the first rather longer, and a little narrower than the second, the bases of the two cells are about level the stem of the first about one-third the length of the cell; posterior cross-vain rather more than its own length distant from the median. Coxæ dark brown; femora and tibiæ mottled with dark purple-brown and yellow scales; all tarsal joints on the hind legs, and all but the last on fore and mid legs with a narrow creamy-yellow basal band. Ungues equal and simple.

Abdomen.—First segment light yellowish-brown, remaining segments with dark brown scales; the second third and fourth have the merest trace of an apical yellow band, on the fifth it is a little more marked while quite half the sixth segment is golden-brown and the seventh and eight almost entirely golden scaled.

Male.—Antennal joints pale and dark brown. Plumes dark and olive-brown. Palpi longer than the proboscis by their last two joints; apical half of ultimate joint golden-brown and there is a narrow golden-brown band at its base, the portion between clad with black scales; the hairs on the joint are very long and are coloured golden-brown on the parts scaled so and black on the black part, penultimate joint black, with a band of golden-brown scales at its base, and a row of long black hairs inserted on either side, antepenultimate joint with a ring of golden-brown scales at its apex, a band of the same beyond its centre opposite a narrow band on the proboscis, and a narrower band nearer its base. Proboscis with a band in width about one-fifth its total length.

Abdomen.—With golden-brown bands on both apex and base of all segments after the second. Fore and mid ungues unequal the larger unguis uni-serrate.

Occurrence.—Described from a series bred from larvæ and adults taken in bungalow at Kuala Lumpur and elsewhere.

Remarks.—A very distinct Tæniorhyncus and in many respects resembling T. Tenax. It is however a much darker mosquito than Tenax the black thorax with it dark scaling and golden lines differing markedly from the thoracic ornamentation of Tenax and Ager. Like T. Ager the wing is much mottled but the pale scales are not so numerous and the lateral scales are not nearly so broad while the female abdomen is only banded on the apical segments is this point it resembles T. Tenax. In the fresh specimens the anterior thorax looks quite black.

Genus 33.—**Mansonia.**—*Blanchard.*

Panoplites.—*Theobald.*

Upper part of head with loosely scattered narrow-curved scales, small patches of spatulate scales on each side and numerous upright scales over the whole upper surface. Palpi four-jointed in the female; last joint minute and nipple-like; three-jointed in the male with a minute nipple-like ultimate joint. Thorax and scutellum with narrow-curved scales. Wings with large broad asymmetrical scales.

Remarks.—Four species occur in Malaya one of which M. Annulifera I have never taken, its description is taken from Theobald's "Monograph." The wings distinguish these Culicines from all the other genera the only other mosquitoes with wing scales at all like it being Orthopodomyia and Aediomyia. The male palpi are also very characteristic.

Mansonia Uniformis.—*Theobald.*

Thorax rich ferruginous-brown with lines of deep golden scales alternating with lines of scales of a rather peculiar shade best described as a greenish-grey. Proboscis yellow with a black band at the apex. Palpi yellow with scattered black scales at the base. Legs much spotted and banded. Abdomen with yellow and white spots and bands.

Female Head.—When denuded light purplish-brown, in some specimens much darker; the centre is clad with scattered long silvery-white narrow-curved scales, some pale yellow ones on the vertex and adjoining portions of the orbital margins, and on either side is a small patch of white spatulate scales and rows of dark brown upright scales over the whole head; vertical bristles bright golden as are the upper orbital but the lower orbital bristles are dark brown. Basal joint of antenna rich apricot and without scales, second joint canary-yellow with a few dark brown scales, remaining joints deep brown with pale brown rings at the insertions of the verticils, which are dark brown in colour. Clypeus ferruginous. Palpi yellow, clad with yellow scales and scattered black ones at the base. Proboscis yellow scaled, except the apical fourth which is dark brown.

Thorax.—Prothoracic lobes rich reddish-brown with long brown bristles and a few white narrow-curved scales. Mesonotum a dark apricot clad with beautifully metallic scales of two colours golden and greenish-grey as follows:—a broad central band of golden scales extending back for about three-quarters the total distance when greenish-grey scales form two lines enclosing the usual bare space at the base of the scutellum outside this band on either side is a broad band of greenish-grey scales succeeded by golden scales to the margin. In some specimens there is a narrow central line of greenish-grey scales then golden then greenish-grey followed by golden, but the first described is the more usual. Scutellum ferruginous, clad with greenish-grey narrow-curved scales on all its lobes; bristles golden-brown. Pleurae brown with dark brown spots. Wings clad with the typical asymmetrical scales, yellow and dark brown; border scales clavate, dark brown in colour; first fork cell longer and much narrower than the second, its base nearer the apex of wing, its stem less than half the length of the cell; posterior cross-vein rather more than its own length from the median. Coxæ creamy-white; under side of femora creamy-white with rings of creamy scales involving the lateral but not the dorsal surfaces, dorsum dark brown;

tibiæ mottled with alternate spots of dark brown and creamy scales, the relative amount of each colour varying in different specimens; metatarsi with dark brown scales and a creamy band in the centre; all tarsal joints in hind leg with basal creamy band, in fore and mid legs all but the last.

Abdomen.—Dorsally clad with rich dark brown scales except the last segment which has a snowy-white band at its apex. All the segments are fringed with golden hairs. There are white lateral spots on segment two, three, five and six those on six being very large and extending on to the dorsum; the venter is clad with creamy and some yellow scales.

Male.—The palpi shew the nipple-like terminal joint peculiar to members of this genus. They are clad with dark brown scales and with silvery scales beneath and the first joint shows two creamy bands and there is a creamy band at the base of the penultimate joint, and the minute ultimate joint is clad with pale yellow scales; there are two rows of long hairs on the penultimate joint and a row of golden spines at the apex of last two joints. Antennæ banded brown and white, plumes olive-brown. Proboscis mottled with dark brown and yellow scales and not distinctly banded as in the female. Fore and mid ungues unequal. The larger unguis is of great size and bears one long bulbous-ended tooth.

Occurrence.—A common house mosquito here. Next to Culex fatigans it is the most troublesome evening biter in my own bungalow but it is not common in the houses at the other end of this town (Kuala Lumpur). It was also common in Dr. Watson's bungalow at Klang. Dusk is the time of its appearance, but I have been attacked in the day by solitary ones in swampy patches. I have bred one specimen from a larva taken in a swamp.

Remarks.—The male of this mosquito is not described in Theobald's "Monograph." A noticeable peculiarity in the males of members of this genus is the minute ultimate joint of the palpi and in this respect it is very different from the males of the genus culex. This mosquito is the only mosquito except Culex Fatigans and other members of the genus Culex here which can be truly termed a night feeder. M. Annulipes is a day feeder and on one or two occasions I have visited jungle after sunset where these mosquitoes were troublesome during the day and not been attacked by one. General experience here has shewn that the vast majority of species of mosquitoes in this peninsula are active during the day and many of them are never seen after sunset.

Mansonia Annulipes.—*Walker.*

Mesonotum deep ferruginous with golden-brown narrow-curved scales and five to seven pale greenish-blue spots; scutellum with pale greenish-blue scales. Wings mottled with dark brown and pale yellow scales; the lateral scales are large broad asymmetrical scales. Legs spotted and banded with creamy and creamy-yellow scales.

Female Head.—Deep dull purple; the upper surface clad with scattered white narrow-curved scales, a patch of small spatulate white scales on either side, and numerous brown upright scales over the whole head. Basal joint of antenna light brown and without scales, second joint canary-yellow at the base dark brown at the apex, with dark brown scales, remaining joints pale yellow at the insertions of the verticils and dark

brown beyond, verticillate hairs dark brown. Palpi about one-third the length of the proboscis, four-jointed, pale yellowish-brown in colour, and clad with deep brown scales with silvery-white scales at the tips. Proboscis with dark brown scales at base and apex paler golden-brown scales in the middle. Clypeus deep purple, unscaled.

Thorax.—Prothoracic lobes dark brown with silvery narrow-curved scales. Mesonotum dark ferruginous, clad with scattered pale golden-brown narrow-curved scales and small spots of greenish-blue scales. The number of these spots varies a little in different specimens, there are always two conspicuous spots one on either side at the level of the junction of anterior and middle thirds of mesonotum, one above the base of each wing, and a line of these scales on either side of the bare space in front of the scutellum, and three in front near the anterior margin. Scutellum purple-brown with a patch of narrow-curved scales on each lobe which are of a pale greenish-blue colour. Pleura dark brown with patches of silvery spatulate scales. Wings with dark brown and pale yellow scales the lateral being very large broad asymmetrical scales; fork cells of moderate length, the first longer than the second, its base a little nearer the apex of the wing, its stem about one-third the length of the cell; posterior cross-vein about twice its own length from the median. Coxæ dark brown with silvery scales, femora clad with dark brown scales and five more or less perfect creamy rings; tibiæ with dark brown scales and with five creamy rings or spots some of the rings going right round, others only shewing on upper or lateral surfaces; fore and mid tarsi with creamy basal bands on all but the last joint, hind with basal ring to all the joints. Ungues equal and simple on all legs.

Abdomen.—With dark brown scales above, patches of white scales laterally, and scattered white scales on the venter. End of abdomen enlarged and turned upwards.

Male Head.—With similar scales to those on the female head except the upright scales, the front rows of which are light brown. Antennæ with dark brown basal joint, the remaining joints are brown at the insertion of the verticils and white at apex and base. The plumes are steel-grey in some lights, rich brown in others. Palpi longer than the proboscis; the first joint is long and clad with dark brown scales and ornamented with two snowy-white bands; the penultimate joint has a white band at the base and beyond is dark brown and this joint bears numerous long black hairs; the ultimate joint is snowy-white very short and the palpi look as though the last joint had been broken off owing to the unusual shortness of the terminal joint. The fore and mid ungues are unequal and the larger unguis of each is unusually large and bears one tooth.

Occurrence.—Described from a series taken in jungle near Kuala Lumpur at Klang, Port Swettenham and Jugra.

Remarks.—A very common and troublesome mosquito in jungle in many parts of the Malay Peninsula. It is curiously local some jungle being absolutely free from it whereas in other places it is very numerous. Whether the vicinity of a large river accounts for its the presence in some places and the absence of a river for the absence of the mosquito I have not been able to satisfy myself but I think this is likely as it is probably a

river breeder for so far I have never found the larva. The male has hitherto not been described.

MANSONIA ANNULIFERA.—*Theobald.*

"Monograph of the Culicidæ of the World."—Theobald.

"Thorax tawny-yellow with four snow-white round spots with a dark line running backwards from the posterior border of the two anterior spots; an indistinct fifth white spot may also be present. Abdomen with white scales laterally and forming bands across the segments, last three segments with many white scales. Legs yellowish-brown all the joints with many white bands."

Female Head.—Clothed with brownish-golden scales and long golden-brown hairs; palpi yellowish-brown with a few scattered dark brown scales; apex snow-white; antennæ brown with pale bands; proboscis yellowish, dark at the base and apex."

"Thorax clothed with bright tawny scales with four distinct round white spots and a dark stripe running backwards from the posterior of the anterior spots ending between or just before the second pair; an indistinct fifth spot may be present.

"Abdomen fuscous with paler apical borders marked laterally with white scales which extend more are less as bands across the abdomen; last three segments with many white scales; each segment has also a border of bristles and is laterally as well as basally darker when denuded; venter with numerous white scales."

"Wings with dark brown and pale scales giving them a mottled appearance."

"Legs all banded for their entire length; anterior femora yellowish-brown with a few scattered black scales with five more or less distinct white bands; tibiæ with four white bands the black scales being more abundant giving the dark bands almost a black appearance; metatarsi banded in the middle; first and second tarsi basally banded white, last two joints covered with dark scales; mid femora darker with only two or three pale indistinct bands; tibiæ with five white bands; metatarsi banded with white at the base and middle; first and second tarsal joints basally white; last two unbanded; femora of hind legs with five white bands and white apex; tibiæ with four white bands metatarsi with basal and middle bands and all tarsi basally white."

Occurrence.—Madras, and has also been taken at Singapore.

Observation.—Differs from annulipes in being much paler of a more uniform yellowish-brown and from Uniformis by the spotted thorax. The description is taken from "Monograph of Culicidæ of the World" as I have no specimen.

MASONIA ANNULATA. N. SP.

Head clad with golden narrow-curved and deep brown upright scales. Thorax black to deep brown with bright golden narrow curved but without the definite lines of silvery-green scales of M. Uniformis. Legs banded and mottled but less so than in M. Uniformis and probosics clad with deep brown scales and a narrow band of golden scales.

Female Head.—Black, clad with golden narrow-curved scales on vertex and occiput and low down laterally a small patch of golden and spatulate scales while numerous deep brown upright scales are inserted on the nape and extend far out on either side. Basal joints of antennæ dark yellowish-brown, second joint with its basal half yellowish-brown with deep brown spatulate scales its apical half brown, remaining joints brown with pale rings at the insertions of the dark brown verticils. Palpi with deep golden scales on the ultimate joints and deep brown scales elsewhere. Proboscis clad with deep brown scales with a narrow golden band in the centre.

Thorax.—Prothoracic lobes deep brown with bristles only. Thorax black to deep brown clad with pale golden narrow-curved scales with a few silvery ones intermixed and a patch of silvery scales on either shoulder. Scutellum dark brown with pale golden scales. Pleuræ deep brown. Wings clad for the most part with scales of the generic type. There are fewer golden scales than in Uniformis. Femora clad with deep brown scales except for three or four golden rings on each femur. Tibia deep brown with golden spots. Metatarsi of each leg brown scaled except for a basal and central creamy-yellow band; first two tarsal joints in fore and mid legs and all in the hind leg brown scaled with basal creamy-yellow bands.

Abdomen.—Clad with deep brown scales without bands or spots.

Occurrence.—Taken in a bungalow Kuala Lumpur and elsewhere on rivers.

Remarks.—Resembles Uniformis but differs in the head scaling, the amount of gold scaling on the proboscis, the absence of definite silvery-green bands on mesonotum, the shape of the wing scales those on the wing of Uniformis being much more acuminate, and the amount of gold scaling on the thighs and legs. The lack of abdominal lateral spots is also a distinctive point. It is a rare species.

Genus 34.—**Orthopodomyia.**—*Theobald.*

Upper part of head with scattered narrow-curved scales which become broader on the vertex, and laterally a patch of spatulate scales on either side, and a dense covering of broad topped upright scales over the whole head. Palpi in the female rather more than half the length of the proboscis, five-jointed the last joint small and nipple-like, in the male the palpi are three-fourths the length of the proboscis, four-jointed, the second joint with a nodal thickening in its middle which might be mistaken for a joint. Proboscis long in both sexes enlarged at the tip which is very blunt and has a ring of erect scales surrounding the labellae. Mesonotum with long narrow and broad-curved scales; scutellum with long hair-like scales. Wings with very large lateral scales, piriform, some exhibiting a tendency to asymmetry like Mansonia and Aedeomyia.

Remarks.—Founded on one specimen sent from the Institute to Mr. Theobald. This genus I have placed at the end of the Culicina as if it were not that the palpi are rather long it certainly ought to come in the sub-family Aideomyina for its affinities with Aedeomyia and Finlaya are very close. The mid legs have a tuft of erect scales at the apex of the femora exactly like those in Aedeomyia but the head and mesonotal scaling

differs. Since the above was written the genus Finlaya has been placed in the Culicinae as the males have long palpi v. "Genera Insectorum 26me Fuscicule 1905."—Theobald.

Orthopodomyia Albipes.—*Theobald.*

Head above clad with silvery-white hair-like scales and numerous upright scales, with brown stems and silvery tops towards the front, those behind and laterally entirely brown. Basal joints of antennæ densely scaled. Palpi more then half the length of the proboscis in the female and not as long as the proboscis in the male. Thorax ornamented with dark brown golden and silvery scales. Dark scaled costa broken by five white spots. Wing scales piriform. Last three tarsal joint of hind legs white.

Female Head.—Deep brown, upper surface densely clad with numerous silvery-white hair-like scales, vertex with a dense tuft of creamy-yellow narrow-curved scales, and the whole upper surface with numerous upright scales in rows, the front rows having brown stems and creamy broad tops with numerous serrations, the hinder rows which extend laterally being entirely dark brown. Basal joint of antenna ferruginous with small creamy ligulate scales, second joint pale yellow with numerous long ligulate creamy scales, remaining joints pale yellow with dark rings at the insertion of the verticils which are dark brown in colour. Clypeus much prolonged forwards, black, with silvery-grey tomentum. Palpi about half as long as the proboscis, five-jointed, the ultimate joint being minute, clad with deep brown scales except for a ring of white scales at the junction of third and fourth joints and white scales on the ultimate joint. Proboscis long, clad with deep brown scales on its basal half with creamy scales on the apical half except for a patch of black scales about the middle on the upper surface.

Thorax.—Prothoracic lobes deep brown with an apical tuft of hair-like golden scales and numerous elliptical creamy scales on the lower portion of each lobe. Mesonotum deep purple, with a band of silvery and golden narrow-curved scales running down the centre of the anterior two-thirds, tufts of silvery scales on the shoulders, a line of silvery scales over the wing roots with a few golden ones towards the front of these lines, and, internal to these is a bare line followed by a line composed of silvery, deep brown and golden scales, and between these in the centre, in front of the bare space at the base of the scutellum, are creamy-white scales. The ornamentation of the thorax is very difficult to describe and is best examined under a 2/3 as under a hand lens the spaces bare of scales appear like patches of dark scales. In the fresh specimen the ornamentation is very fine but as the thorax dries the scales which were lying flat are erected and their directions altered and the pattern alters with them. The scutellum is light yellowish-brown clad with silvery scales which are long and some are twisted almost like the scales on Mucidus. Scutellar bristles light brown. Pleuræ dark purplish-brown with patches of scales some elliptical some ligulate and others long and curved. Wings long and clad with deep brown and snowy-white scales. The white spots on the costa are five, the basal two only involve the costa, the third extends evenly on to the stem of the fourth vein, and fourth spot extends practically across the wing, the fifth is at the junction of second

long vein with costa. The scales are for the most part piriform but a few are symmetrical; the fork cells are long, first longer and narrower than the second, its base nearer the wing apex, its stem about as long as the cell. Coxæ deep brown, the fore coxæ densely scaled with creamy-yellow scales; femora with dark brown scales above, creamy ones below and laterally, all the tibiæ with two narrow creamy rings at the base separated by a narrow band of black, and a creamy-yellow ring at apex; metatarsi and all tarsal joints of fore and mid legs with creamy basal band; in the hind leg last three tarsi entirely creamy scaled. Ungues equal and simple on all the legs.

Abdomen.—Purple-brown above with two creamy spots on each segment.

Male.—With ochraceous plumes, the antennal joints being banded black and white and the joints from the second to fifth both inclusive, with numerous linear silky-white scales. Palpi four-jointed about three-fourths the length of the proboscis with the apices white scaled and two rings of creamy scales on each palpus. Abdomen with creamy basal bands as well as the two white patches on each segment.

Occurrence.—Described from a large series bred from larvæ taken from water in bamboos.

Remarks.—Entirely sylvan and I believe a non-blood-sucker, this mosquito is not often seen though the larvæ are common enough in jungle where bamboo is present. They have many points in common with Finlaya and Aediomyia. I have therefore placed the genus at the end of this sub-family it is possible it should be placed with the Aediomyina. It is easily recognised as its characters are in some respects unique.

Orthopodomyia Nigritarsis. var.

The only difference between this mosquito and O. Albipes is the presence of a black band near the apex on the second and the third tarsal joints of the hind leg whereas in Albipes the last three joints of the hind tarsus are clad entirely with snowy-white scales. The abdominal segments in the male of Albipes have all a very narrow basal white band and two white spots in the middle of each segment in the male of nigritarsis only the last four segments of the abdomen have bands and they are broader than those on the abdomen of albipes. The band at the apex of the male proboscis in Albipes is broader than that in Nigritarsis. These specimens were found with the larvæ of the previous species in a hollow in a tree on a small island Pangkor Laut, by Dr. Daniels, but careful examination revealed no difference between the larva and that of O. Albipes.

Sub-Family **CULICINA.**

Genus.—**Etorleptiomyia.**—*Theobald.*

Position undetermined.

"Head clothed with a mixture of narrow-curved scales, upright forked ones and small loose flat scales all over; antennæ scaly on the basal joints. Thorax with scales of mesonotum narrow and curved, those of the scutellum flat and small. Abdomen clothed with flat scales. Wings with very marked heart-shaped scales on the basal halves of the second, third, fourth and sixth veins, on the first long vein, base of second and fourth, also with more or less Mansonia-like scales, and along costal border also; scales on the apical half of the veins pedunculated and clavate, peduncles very short; costa spiny; fork cells moderately long."

The above is from Theobald's notes on mosquitoes in "The First Report of the Wellcome Research Laboratory," Khartum. He only describes the female but the male here described resembles his species in the character of the wings, cephalic and scutellar scaling so closely that I feel sure it is the male of a member of this genus. The male proboscis has a wonderfully close resemblance to that of species of the Genus Mimomyia. It is apparently a member of the sub-family Culicina.

Etorleptiomyia Completiva. n. sp.

Head deep black with numerous silvery curved scales on the upper surface and deep brown spatulate scales at the sides. Prosboscis much enlarged apically. Thorax black with silvery narrow-curved scales. Wings mottled with black and yellow cordate and asymmetrical scales.

Male Head.—Deep black, clad above with silvery narrow-curved scales, laterally with deep brown large spatulate scales and on the occiput with broad topped upright scales many of which have white tips. Basal joint of antenna deep brown, with small creamy clavate scales, remaining joints deep gold with golden plumes. Clypeus deep brown and nude. Palpi slender, about three-fourths the length of the proboscis with three apparent joints, the ultimate being minute and clavate, clad with golden scales for the most part except for a patch of black scales on the upper surface at the base and in the middle, and black scales on the ultimate joint with a few white ones on its upper surface. Proboscis longer than the palpi and with the apical half much swollen, clad with deep golden scales except for some black ones at the base.

Thorax.—Prothoracic lobes black clad with small silvery scales. Mesonotum black with a broad band of silvery narrow-curved scales in the centre some silvery scales on the shoulder and over the wing roots elsewhere clad with black narrow-curved scales. Scutellum deep brown with spatulate scales black and light yellowish-brown. Over each wing root on the mesonotum is a dense tuft of black ligulate scales. Pleuræ

llowish-brown with dark brown spots, and patches of scales. Wings ottled with black and deep yellow scales. These scales are very broad, any are asymmetrical with notched ends and others cordate; fork cells ng, the first a little narrower and much longer than the second, its base arer the wing base, its stem about one-fifth the length of the cell; posterior oss-vein distant from median about $1\frac{1}{2}$ times its own length. Coxæ llowish-brown with brown and white flat scales, femora clad above with rk purple-brown scales, below chiefly ochraceous, tibiæ with dark scales the upper surface, ochraceous scales elsewhere, hind tibiæ with a patch dark purple-brown scales at the apex above and laterally; metatarsus and rsus of the fore leg ochraceous, on the mid there are three patches of rk purple scales on the upper or outer surface, one just before the apex the metatarsus, one in a similar position on the first tarsal joint, and one the middle of the second tarsal joint; on the hind leg there is a ring of dark ales just before the apex of the metatarsus, two on the first tarsal joint, ie broad, one in the middle of the second and also on the third tarsal joint. ore and mid ungues unequal the larger unguis on each leg being uni-rrate.

Abdomen.—On the dorsum is a broad stripe running down the centre r the whole length dark purple-brown in colour. At the base of each gment on either side is a narrow band of dark scales, everywhere else the ales are dark golden-yellow.

Occurrence.—Described from one specimen sent to me by Dr. FINLAYSON Singapore.

Remarks.—The wing scales in this species are so exactly like those gured in the "First Report of the Wellcome Research Laboratories," hartum, and there are so many other points of resemblance with the embers of this genus that I have no hesitation in assigning it here. Ir. THEOBALD only describes the female, here only the male is described. ee "Remarks" under Dasymyia and Conotiomyia.

Sub-Family **AEDEOMYINÆ.**—*Theobald.*

Characters.—Head with flat racquet-shaped and upright scales in a genera except Deinocerites and Aioretomyia. Thorax and scutellu variously clad. Palpi extremely short in both sexes. Metanotum bare.

Remarks.—A sub-family based on the short palpi in male and femal but containing genera of widely different characters. The genus Aede is closely allied to culex and the genus Aedeomyia to Finlaya and Orthc podomyia. Finlaya was included in this sub-family by Theobald in th third volume of his "Monograph," but he has now placed it in the Culicin as the males have long palpi.

Synoptic Table of Genera.

Section I.—Head with narrow-curved and upright scales only. Second antennal joint long.

(*a.*) Thorax and scutellum clad with narrow-curved scales.....*Genus* 1.—Deinocerites

Section II.—Head with flat and upright scales only; thorax with narrow and broad fusiform scales.

(*a*) Scutellum with racquet-shaped scales on the median, and long spatulate scales on the lateral lobes. Tufts of erect scales at femoro-tibial joints of mid and hind legs.....*Genus* 2.—Aedeomyia.

Section III.—Head with narrow-curved, upright and either spatulate or racquet-shaped scales.

(*a.*) Scutellum with narrow-curved scales.

(A.) Fork cells long, lateral wing scales clavate....*Genus* 3.—Aedes.

(B.) Fork cells of medium length, lateral wing scales broadly linear.....*Genus* 4.—Aioretomyia.

(*b.*) Scutellum with spatulate or racquet-shaped scales. .....*Genus* 5.—Acalleomyia.

Section IV.—Head with spatulate or racquet-shaped and upright scales only.

(*a.*) Scutellum with narrow-curved scales.

(A.) Thorax with narrow-curved scales only .....*Genus* 6.—Verrallina.

(B.) Thorax with long narrow scales with truncated ends. Wings with large broad scales.....*Genus* 7.—Mimomyia.

(*b.*) Scutellum with racquet-shaped or spatulate scales.

(A.) Thorax with narrow-curved scales and some fusiform or lanceolate scales at the sides or in the centre. Fork cells very short; lateral wing scales fusiform. .....*Genus* 8.—Uranotaenia.

(B.) Thorax with narrow-curved scales only.

(1.) Fork cells short but not so short as in Uranotænia; lateral wing scales narrow clavate.....*Genus* 9.—Ficalbia.

(2.) Fork cells medium; lateral wing scales with dentate ends.....*Genus* 10.—HODGESIA.

(3.) Fork cells very short not more than quarter the length of the wing; wing scales short and linear. Proboscis very long.....*Genus* 11.—ZEUGNOMYIA.

(4.) Fork cells medium. Proboscis very long. Wing scales linear colouring metallic.....*Genus* 12.—COLONEMYIA.

(C.) Thorax with narrow-curved scales and a central band of broadly ovate scales. Colouring metallic.....*Genus* 13.—TOPOMYIA.

(D.) Thorax with flat scales. Colouring very metallic. .....*Genus* 14.—HÆMAGOGUS.

(E.) Thorax with fusiform and spatulate scales. Clypeus scaled. Colouring dull.....*Genus* 15.—SKEIROMYIA.

Genus 1.—**Deinocerites.**—*Theobald.*

Brachiomyia.—THEOBALD.

No representative of this genus has as yet been found in Malaya.

Genus 2.—**Aedeomyia.**—*Theobald.*

"Head densely clad with numerous racquet-shaped scales in imbricate ws at the sides but loosely scattered above, and broad upright scales ove and laterally. Antennæ moniliform and scaled on the two first ints."

"*Thorax.*—With broad spindle-shaped scales; scutellum with flat broad ales. Abdomen densely scaled with flat scales. Legs densely scaled pecially at the apices of the femora and bases of the tibiæ; ungues of female ual and simple of fair size on the hind legs; of the males unequal on the re and mid legs larger ones toothed. Wings densely scaled with broad ymmetrical scales somewhat similar to those in the genus Mansonia and so with elongated lateral ones; border scales large fringe scales at the se of the wing very long; fork cells unequal base of the second posterior ll nearer the base of the wing, etc."

"This genus is closely related to Aedes but differs from it in the aling of head and wing. It occurs in South America, India, Malay eninsula and Australia." The above is quoted from THEOBALD. There ems to have been some error (possibly due to having only denuded specmens to describe from) as to the head scaling. There are numerous nall broad racquet-shaped scales together with narrow spatulate scales in e centre and at the sides of the head. The scales on the thorax are of ree kinds spindle-shaped scales of medium breadth forming a central eamy-yellow line numerous small very broad scales on the humeral rtions in front and large spatulate scales over the wing roots. On the ntral lobe of the scutellum in front of the creamy-yellow racquet-shaped ales are a few very large dark brown ob-conical scales."

I cannot agree with Mr. THEOBALD that this genus is closely related Aedes. Even the male palpi, the only point of agreement, are very fferent from those in Aedes. They are much longer in relation to the

proboscis and have evidently three or four joints instead of two as in t male Aedes. The nearest relations amongst the mosquitoes in Malaya a without doubt Orthopodomyia and Finlaya both of which genera have ve close affinities.

Aedeomyia Squammipenna (Vol. II.—*Theobald*).

Aedes Squammipennis.—Arribalzaga.

Mesonotum dark brown clad in front of the wings with creamy a creamy-yellow scales and a dark eye-like patch of dark brown scal between wing and shoulder on either side. Wings with broad asymmetric scales brown and white. Legs mottled with numerous white rings a spots, mid and hind legs with tufts of long scales at the apex of each femu

Female Head.—Slate-black ; a tuft of long spatulate creamy scales the vertex between the eyes, behind this, and on the adjacent orbit margins are numerous loosely scattered creamy scales triangular in shap a line of similar scales runs back to the occiput; on either side is a pat of broad short spatulate scales some of which are slate-black in colo others are of a pale olive-brown, numerous upright scales cover the occip and spread forwards nearly as far as the vertex ; in front these are cream yellow, behind they are dark brown; vertical and orbital bristles brow Antenna Moniliform, basal joint dark brown clad with small elliptic scales, second joint as long as any three succeeding joints densely scaled its middle third with blackish-brown scales, remaining joints blackis brown with dirty white rings at the insertion of the verticils ; verticilla hairs dark brown. Clypeus dark brown clad with two rows of whi spatulate scales in the centre. Palpi less than one-third the length of t proboscis, heavily scaled with dark brown scales and white scales at t apices. Proboscis with dark brown scales and three white rings, one the level of the apex of the palp, one about halfway and one at the ap before the labellæ.

Thorax.—Prothoracic lobes dark brown clad with white racquet-shap scales. Mesonotum dark brown clad with scales which differ somewh in colour in different specimens. In a typical specimen the anterior porti (*vide* introductory remarks) is for the most part clad with creamy scal which in the centre are spindle-shaped, at the sides in front more racque shaped, and over the wings long and spatulate ; on either side is a lar spot composed of dark brown spindle-shaped scales ; the posterior half mesonotum is clad with more or less spindle-shaped creamy scales in t centre, and mixed creamy and brown scales at the sides. In other spe mens the broad central line of spindle-shaped scales is distinct honey-yello The brown scales are so near the colour of the mesonotum that they a not easily seen, but with care in a good light there can be no doubt as their presence. Scutellum ochraceous, clad with broad racquet-shap creamy scales on the central lobe and large dark brown scales with tru cated ends on the lateral lobes ; on the apex of the central lobe are insert a few dark brown broad spatulate scales ; scutellar bristles dark brow Pleuræ dark brown with patches of white racquet-shaped scales. Win densely scaled with broad asymmetrical and numerous lanceolate scal dark brown, ochraceous, and white in colour. There are two white spo

on the costa one near the base extending to the first long vein, one at the junction of middle and apical thirds which extends to the second long vein just where it forks; another white spot present at the base of the second fork cell and another at the base of the fork of the fifth vein; for the rest the ochraceous and dark brown scales are scattered in patches and spots over the rest of the wing. Cross veins cannot be seen owing to dense scaling. Femora and tibiæ of fore legs mottled with dark brown ochraceous scales and the tibiæ with six semi-rings of white on the external surface, meta-tarsus dark brown with three white semi-rings, first two tarsal joints with white basal banding broader above than below; mid legs similar except for the presence of tufts of long clavate scales on both sides of the femoro-tibial joint; femora and tibiæ of hind legs same as middle; meta-tarsus and first tarsal joint with apical and basal bands, second and third tarsal joints creamy scaled except for short black ring at the apex, last joint creamy.

Abdomen.—First segment clad with ochraceous scales, second with ochraceous scales except for a line of dark brown scales in the centre, remaining segments with dark brown scales and a square patch of ochraceous scales on either side near the apex of each. Apical segment swollen and densely clad with white, dark brown, and golden-yellow scales. White lateral spots at the base of each segment. Venter with ochraceous scales predominating on the basal segments dark brown on the apical segments.

Male.—Antennæ plumose hairs silky-brown; last two joints not much longer than preceding but somewhat swollen. Proboscis longer than in the female with only one white band which is in the centre where the labium appears to be jointed. Fore ungues long but one rather longer than the other and this bears a long sharp tooth near its base; mid ungues similar to fore ungues. In all other respects the male resembles the female.

Occurrence.—All the specimens have been caught in my own bungalow in Kuala Lumpur at various times of the year.

Remarks.—I have never known this mosquito bite but then I have not observed very many specimens. Its attitude is very characteristic the body instead of being supported on the legs away from the surface on which it is resting is pressed down against the surface the femoro-tibial joint of the mid and fore legs being acutely flexed to permit of this the hind legs also being pressed to the surface and not curled up as in most mosquitoes. This is another point in which it resemble Orthopodomyia. There is no other species in Malaya it could be confused with the tufts of long scales on the mid and hind legs at once distinguishing it.

Genus 3.—**Aedes.**—*Meigen.*

"Head clothed with narrow-curved scales on the middle flat ones laterally which spread much further on to the occiput than in Culex, the narrow curved scales often forming only a broad median line. Scales of the mesothorax narrow and curved or almost hair like, scutellum with narrow curved scales, and with six bristles on the mid lobe. Wing scales much as in culex the lateral ones long and thin, the median small and flat;

fork cells moderately long about quarter the length of the wing. Palpi small in both sexes two-jointed in the male, four-jointed in the female, the apical joint minute."

This genus is closely related to culex and Melanoconion on the one hand and less so to Aioretomyia amongst the Aedeomyinæ. In fact nothing could better shew how unscientific is a classification based on palpi than that genera so closely related as Culex, Melanoconion and Aedes should be placed in different families. One species have so far been found in Malaya.

Aedes Malayi. n. sp.

A small mosquito of slender build, general colour dark brown with black margins to the wings. Head clad above with dark blue-grey scales with a pale margin to the eyes and pale scales on the genæ. Thorax muddy-brown clad with lines of black narrow curved scales. Abdomen covered with black scales with a few white ones scattered irregularly among the black and pale basal bands on the first three or four segments. Legs purple-brown unbanded.

Female Head.—Dark slate-grey, in some lights it has a slightly brown tint especially at the orbital margin, covered almost entirely with flat racquet-shaped scales with a few pale grey narrow-curved scales arranged in a triangular patch in the centre of the head with the racquet-shaped scales on either side and dark brown upright scales over the whole upper surface. Under a hand lens the scales along the orbital margin and beneath on the genæ are pale blue-grey, above, and at the sides, the scales are of a purple-brown. Under a 2/3 these scales appear grey or brown or purple according to their position with respect to the light. Vertical bristles change colour as do the scales.

Basal joint of antenna under a hand lens is mouse-grey. Viewed under a 2/3 it may appear light muddy-brown or grey. There are a few pale hairs on its inner face difficult to see, second joint pale grey at the base darker at the apex, remaining joints dark grey, paler at the insertion of the verticils, clad with numerous pale hairs, verticillate hairs dark grey. Clypeus mouse-grey and nude. Palpi about one-eighth the length of the proboscis clad with light mouse-grey scales. Proboscis slender, except for the apical quarter which is enlarged, clad with purple-brown scales. Labellæ pale brown.

Thorax.—Prothoracic lobes very large and prominent, dark grey in colour with a line of brown bristles anteriorly and a very few narrow curved scales pale grey in colour inserted on the posterior aspect. Mesonotum of a muddy-brown tint with two dark purple-brown lines on either side of the middle line and covered with lines of narrow-curved scales which under a hand lens are purple-brown. Pleuræ without scales, muddy-brown. Wings dark brown covered with purple-brown scales. Anterior edge of costa spinous. Veins thickly clad especially costa and first long vein, the second long vein basally has very narrow linear lateral scales and narrow median scales with square ends but on the branches there are also clavate scales especially at the apex of the wing and the median scales seem to be

lost; the same applies to the fourth vein and branches; there is a double row of median on the third right to the apex. First fork cell much longer than second its base nearer base of wing, two cells of about equal width, stem of first cell very short, not a quarter the length of the cell. Median and supernumerary cross veins meet at an angle, posterior cross vein about twice its length from median. Coxae white, femora pale scaled beneath, above and laterally, except at the base of the hind femora, scaled with dark purple-brown scales. Tibiæ, metatarsi and tarsi clad with purple-brown scales. There is no banding. Ungues small equal and simple on all legs. Metanotum muddy-brown.

Abdomen.—Dorsally clad with scales which appear almost black unless the light is good, when they shew dark brown or purple-bronze.

The male is generally lighter coloured than the female, the wing is more lightly clad and the fork cells are shorter. There are two golden-brown vertical bristles on the head which are absent in the female. The antennæ are more definitely banded and are plumose, the plumes being dark brown though in a strong light they look paler and the colour is not well seen. The male fore and mid ungues are unequal but simple, the hind equal and simple. Palpi very short.

Occurrence.—All the specimens were bred from larvæ taken in a pond in Kuala Lumpur. I have never taken this mosquito in a house.

Remarks.—A true Aedes with typical scaling and male palpi. The wing in length of fork cells resembles culex but the scales are rather that of Melanoconion. I do not know whether this mosquito bites or not.

Genus 4.—**Aioretomyia.**—NOV. GEN.

Head clothed with a central line of crescentic scales and outside this more or less racquet-shaped scales compactly laid while behind on the nape are a few rows of upright scales. Thorax and scutellum with crescentic scales. Female palpi three-jointed. Male genitalia complex.

Remarks.—This genus resembles Verrallina except in having crescentic scales on the head. It also closely resembles Howardina now placed in the sub-family Culicinæ though formerly in this sub-family. There are four Malayan species all apparently new.

Aioretomyia Varietas. n. sp.

Of median size. Proboscis rather long about as long as the abdomen. Palpi less than a quarter the length of proboscis, three-jointed. Head with spatulate scales and a few pale flaxen narrow-curved scales on the orbital margin on either side and a few on the nape with some dark upright forked scales. In a fresh specimen not long hatched the thorax is light yellowish-brown but in older specimens it is reddish-brown with three lines of dark brown scales. Abdomen dark brown scaled, with large basal triangular creamy patches, venter with ochraceous scales having a metallic lustre; legs dark brown; fore and mid ungues uni-serrate in the female.

Female Head.—Dark brown, a line of narrow-curved pale golden scales runs down the centre and broadens out over the nape into a triangular patch,

a few golden narrow-curved scales run along the orbital margin from the vertex for a short distance ; on either side of the central line the head is clad with spatulate scales with rounded ends of a rich dark brown colour with purple reflections and more laterally is a broad band of pale golden spatulate scales succeeded by dark brown scales. There is considerable variation shewn in different specimens. In some the narrow scales are only seen on the nape and along the orbital margins the central line being absent. The lateral spot is a semicircular spot in some in others it is a broad band running back to the margin of the occipital foramen. There are a few dark brown upright forked scales on the nape. Basal joint of antenna in some ochraceous with a dark shading on the inner face, in other specimens ferruginous with a few hairs and small scales (very difficult to see) on the inner face, second joint longer than succeeding joint coloured at the base like the basal joint darker at the apex with a very few small brown scales and some brown hairs besides the verticillate hairs, remaining joints dark purple-brown with numerous short white hairs and dark brown verticils. Clypeus dark ferruginous or lighter yellowish-brown in some, large and nude. Palpi vary somewhat in length in different specimens, from about one-sixth to one-seventh the length of the proboscis, three-jointed, first joint constricted in the middle, second of a pyramidal shape the broadest part at the apex, about as long as first joint, third joint longer than either of the others, elliptical. There is no small terminal joint and I have no less than six mounted preparations of the palpi but cannot make more than three joints in any one of them. The palpi are clad with dark brown scales and numerous short hairs. Proboscis shorter than the abdomen (though it varies slightly in different specimens) clad with dark purple-brown scales.

Thorax.—Prothoracic lobes dark brown and frosted. At the lower end in a good many of the specimens is a distinct projection like a teat and it is to be observed even in a fresh undried specimen so cannot be due to distortion in drying. There are two vertical rows of dark brown bristles but most of the specimens shew no scales. Mesonotum varies much in colour according to the age of the adult fly as freshly hatched specimens are light yellowish-brown whereas those caught in the jungle are dark brown or reddish-brown. The usual colour is brown with darker brown lines one in the centre one on either side of this and a dark patch in front of the scutellum and over the base of each wing; these lines are not always to be seen they are best seen under a 2/3 power. On the anterior margin are three patches of golden scales which under a hand lens appear as a line; there is also a small patch of golden scales over the base of each wing, the remainer of the mesonotum is clad pretty thickly with light brown narrow-curved scales which under a hand lens appear as a dense feltwork of purple-bronze scales; they look darker because they take the colour of their background. In some specimens the linear arrangements of the scales is much more plainly seen. In some lights under a 2/3 many of the scales shew golden-brown in a good light. Scutellum dark brown; central lobe clad with golden-brown narrow-curved dark scales, dark brown scales on the lateral lobes; bristles dark brown, the numbers on the central lobe varying considerably four to six being a common number but sometimes seven are present sometimes only five. There are always a few shorter bristles anterior to the long bristles and sometimes one or more of these is more developed.

Pleuræ light muddy-brown or yellowish-brown with patches of rather long spatulate brilliant white scales and numerous short white hairs. Wings brown with dark brown scales; anterior edge of costa with spinose dark brown scales, subcosta well separated from costa, clad with rather long scales enlarged apically and having square ends; first long vein ending very near the apex of wing with a double row of narrow spatulate median scales and clavate lateral scales on either edge on all the part beyond the end of subcostal vein; double row of median scales on second, third and fourth veins and rather narrow clavate lateral scales; no lateral scales on fifth or sixth vein; first fork cell about as long as its stem, longer, but no narrower, than the second, its base nearer the wing base; supernumerary and median veins almost in a line with one another, posterior cross vein a trifle more than its own length distant from median. Coxæ pale muddy-brown. Just above the fore coxa on either side is a rounded protuberance which is evidently part of the prothorax which in this mosquito is much more complete than is usual. This protuberance is clad with flat white scales. The fore coxa is covered with flat scales in front which are white on the upper corner and dark brown below, there are also numerous dark brown hairs and on the inner surface some pale scales. There is a line of white scales on the outer surface of each of the remaining coxæ; femora clad with dark brown scales with purple reflections above, with pale scales beneath which in some lights shew silvery iridescence; the apex of each femur is clad with dark purple-brown scales on every surface and there is a row of spinous golden-brown scales inserted on the under side of each; tibiæ clad with dark scales with two rows of golden-brown spines towards the anterior surface and on the posterior surface numerous spinose scales projecting outwards and downwards give the leg a somewhat shaggy appearance; there are a few pale scales at the apex of each tibia. Tarsi and metatarsi dark brown scaled. Ungues equal and uni-serrate on fore and mid legs, simple behind.

Abdomen.—Clad with dark scales above except the last segment which is pale fawn-brown, with large basal quadrilateral white spots; venter pale yellowish-brown, but in drying this may entirely disappear the lateral spots being drawn together beneath and giving the idea of ventral basal banding. Female lamellæ prominent.

Male.—The male differs from the female in the following points. Antennal basal joint large, dark blackish-brown in colour, second joint swollen with a projecting ridge on its inner face upon which are inserted a few small dark brown scales, remaining joints banded brown and white, last two joints much elongated. Plumes long silky purplish-brown. Wings more lightly scaled though the male wing is much more like that in the female than in most mosquitoes. Joints of the palpi indeterminate.

Genitalia.—The tergite and sternite of the eighth segment are expanded laterally and form valve-like flaps above and below the ninth or genital segment which consists of a very small plain edged tergite or sur-anal plate and two lateral lobes. The transverse section of the lateral lobes is roughly semi-circular the surface corresponding to the diameter being parallel to the dorso-ventral plane. Internal and ventral to these lobes are a pair of internal claspers consisting of stout hollow chitinous tubes which at a

distance from their base greater than the length of the genital lobes bend on themselves backwards and then curve inwards. At the first bend is a sharp edged triangular process. The falciform end is solid flattened from above downwards and serrated on it posterior edge. On the apex of the genital lobe is a stout spine like process and lower down and more ventral is another chitinous bar with a blunt dentate end. These two processes are hinged and work in planes at right angles to one another.

Occurrence.—Fairly common in jungle. Specimens taken around Kuala Lumpur at Ulu Gombak, Pangkor Laut and Klang.

Remarks.—I only possess one male bred from a larva. The female is common in jungle and a vicious biter. I have described the genitalia at some length as they are an important specific character in this genus. They differ from *A. Singularis* in being much less prominent and the ventro basal chitinous rod is not nearly as long or curved neither has it the long tooth. From *A. Aedes* it is easily distinguished by the presence of abdominal spots and the much more complex genitalia.

Aioretomyia Singularis. n. sp.

Head with golden narrow scales on vertex and adjoining portion of orbital margins, black scales elsewhere with pale lateral spots. Thorax brown with darker brown lines and fawny-brown narrow scales. Abdomen with white lateral spots. Genitalia very conspicuous.

Male Head.—Dark brown with a bare line in the centre; some golden narrow-curved scales on the vertex and a line of them extending from the vertex along the orbital margin on either side for a short distance; all the rest of the head as far as can be seen is clad with blackish-brown spatulate scales with rounded ends except for a small ill-defined spot of pale scales low down on the orbital margin. The nape is pressed against the thorax which prevents the upright scales which doubtless exist from being seen. Basal joint of antennæ large dark brown being darker on the inner side, second joint resembles that in the other males of this genus in being swollen and ridged on its inner face about the centre for the insertion of a few dark scales, remaining joints banded brown and white with long plumose verticils of a dark purple-brown colour. Clypeus large, dark brown, nude. Palpi small, certainly three, probably four, jointed, clad with dark brown scales. Proboscis long, rather longer than the abdomen, clad with dark brown scales with purple reflections.

Thorax.—Prothoracic lobes dusky-brown clad with a few dark brown narrow-curved scales and some dark brown bristles. Mesonotum dark reddish-brown with thin darker brown lines and dark patches at the sides rather sparely clad with narrow curved scales which vary with the light from black to dark brown or lighter fawn-brown, and numerous dark brown bristles. Scutellum dark brown, the lateral lobes lighter than the central; central lobe with six dark brown bristles and pale brown narrow curved scales; lateral lobes dark brown almost black. Pleuræ dark brown frosted in patches, and with patches of silvery-white spatulate scales and rows of short bristles. Wings brown, clad with dark brown scales spinose at the apical half of the anterior edge of costa, large and spatulate on the subcosta, first vein

long and very distinct clad with a double row of small median scales and on the upper edge of the apical fourth with clavate lateral scales; branches of first fork cell with numerous rather large clavate lateral scales, a few lateral scales on the apical half of third vein, and a few on the branches of second fork cell; stem of first fork cell with double row of median scales; all the remaining veins posterior to it with a single row of median; fork cells of about equal breadth and with their bases level, the first longer than the second, being a trifle longer than its stem. Median and posterior cross veins of about equal length, posterior distant from median rather more than its own length. Coxæ muddy-yellow with white scales on all, and some dark ones on the fore coxæ and a row of hairs; fore femora almost entirely dark brown scaled, with a row of large golden-brown spines and a ring of spines round the apex; tibiæ with dark brown scales and short spines; tarsus with fawny-brown scales, only seen in certain lights, in some lights the scales look as dark as those on the tibia. Mid and hind femora dark brown above with silvery scales beneath; some pale scales at the apex; tibiæ with dark brown scales and a ring of pale ones at the apices; short spines on the mid tibiæ much longer ones on the hind tibiæ; metatarsi and tarsi with dark brown scales presenting the same difference of shade with change of lights as those on the fore tarsi. All the brown scales in some lights show metallic-bronzy reflections. Fore and mid ungues large and unequal; the large unguis uni-serrate; hind simple and equal.

Abdomen.—With dark purple-brown scales above and quadrilateral pearly-white basal spots to each segment. The segment bearing the genitalia is much enlarged. The tergite is of a pyramidal shape with deep notch in the apex. It is purple scaled at the base, of a greyish colour on the margins and at the apex the grey surrounds a small tawny unscaled area. The margin bears numerous golden hairs. The basal piece of each clasper of unusual size and round in shape clad with numerous long pale golden hairs. At the apex a pair of claspers are inserted the larger being of great length and two pronged and being inserted on the posterior of ventral margin of the basal piece while the other smaller clasper is inserted more anteriorly and consists of a thick dark brown chitinous spine with a blunt tooth on one edge. At rest they look backwards and inwards. The internal pair of claspers can be made out with difficulty owing to the direction the fly has set in. The large external claspers first bends upwards (dorsal-wards) and then sharply inwards and at rest the prongs of the opposite claspers interlock. I know of no mosquito with genitalia in any way comparable to this mosquito.

Remarks.—Described from one male taken in my bungalow Kuala Lumpur at evening. It is a distinct Aioretomyia with a few narrow-curved scales on the vertex and nape flat scales elsewhere short palpi and curiously complex genitalia.

Aioretomyia Aedes. n. sp.

Head almost black, covered with scattered racquet-shaped scales, pale ochraceous on the vertex, bluish-grey elsewhere, a patch of pale golden narrow-curved scales behind and several rows of dark brown upright forked scales. Thorax brown. Abdomen and legs brown the scales at the base of the abdominal segments pale giving a faintly banded appearance.

Male Head.—Brownish-black with a patch of pale golden narrow-curved scales behind, scattered blue-grey racquet-shaped scales over the occiput and sides, and a patch of ochraceous scales on the vertex, numerous dark brown upright forked scales behind and at the sides. The broad scales are thinly scattered and do not overlap leaving space between. Antennæ plumose; basal joint brown with hairs or small scales on the inner face, remaining joints silvery-white with a narrow brown ring at the insertion of the verticils; verticillate hairs brown. Clypeus brown. Palpi slender, about one-fourth the length of the proboscis, apparently four-jointed, clad with brown scales. Proboscis slender, shorter than abdomen clad with brown scales.

Thorax.—Prothoracic lobes dark brown, with a row of bristles but no scales. Mesonotum brown, clad with narrow-curved scales some of which are black at the base and pale at the tip, others are very pale fawn; bristles dark brown. Scutellum brown with narrow-curved scales which are almost white; bristles dark brown, five to the central lobe. Pleura brown with darker brown patches and rows of bristles and a few spatulate scales which take the colour of their background. Wings clad with dark brown scales spinose on the costa; median scales long, lateral long, and slightly clavate; first fork cell same breadth but longer than second its base nearer wing base, its stem about one-third the length of the cell; posterior cross vein about three times its own length from the median. Legs with dark brown scales except on the under surface of the mid femora and the whole of the hind femora where the scales are pale brown; fore and mid ungues unequal but in a very slight degree, the larger unguis slender, sharp pointed and uni-serrate.

Abdomen.—Clad above with dark brown scales which at the bases of the segments become pale and give an ill-defined banded appearance. There are numerous pale brown hairs at the edges of all the segments. The genitalia consist of a basal piece with two brush-like tufts of golden-brown stiff hairs on the inner side of each and small simple claspers at the apices.

Occurrence.—Described from one male bred from a larva taken in a pond, Kuala Lumpur.

Remarks.—Though I have placed this mosquito doubtfully here it differs in many points from the other members of this genus. The head scaling is notably different for in the other species of Aioretomyia the scales are laid like tiles on the roof. The absence of scales on the prothoracic lobes the simple genitalia and the very long fork cells are all points of difference.

Aioretomyia Tæniata. n. sp.

A few ochraceous narrow curved scales in the middle line of head and on the vertex, elsewhere broad spatulate scales with rounded ends, purple-black over the central area, ochraceous at the sides. Thorax dark brown with darker brown lines and covered with bronzy-brown narrow scales. Abdomen with basal white bands and large lateral spots. Legs with dark brown scales, a pale ring at apex of hind femora. Female ungues uni-serrate on fore and mid legs.

Female Head.—Central area covered with purple-black spatulate scales with rounded ends, with a median line of pale ochraceous narrow curved scales a few ochraceous narrow-curved scales along the upper half of the orbital margins and some flat ones behind on the occiput. On either side is a band of ochraceous spatulate scales much more marked in the type than the other specimen I have, vertical bristles brown, orbital pale tawny, and very short and thick. Basal joint of antenna dark brown with minute black scales on the inner face, second joint pale at the base, dusky beyond with a few small spatulate black scales inserted at the junction of the pale and dark portions, remaining joints dusky with numerous silky-white hairs and dark brown or black verticils. Clypeus blackish-brown and nude. Palpi four (?) five-jointed; two first joints very short of about equal length; third joint large, about as long as the two first together, followed by a long elliptical joint about equal to the first three joints in length and which I am almost certain is two joints for in certain positions a distinct ring-shaped depression can be seen about one-fourth of the length of the joint distant from the apex, clad with black-brown scales as is the proboscis which is rather shorter than the abdomen and stout.

Thorax.—Prothoracic lobes dark brown with bristles only, no scales. Mesonotum dark brown with faintly marked darker brown lines, clad with narrow-curved scales, a few pale tawny ones on the anterior margin and over the wing bases, elsewhere they are of an indefinite fawny-brown or in some lights mouse-grey. Under a hand lens they are bright bronze. Pleuræ shew a large dark brown patch centrally and the parts round this are of muddy-brown. There are patches of silvery flat scales which are long blunt-ended spindles in shape. Scutellum pale brown centrally, blackish-brown at the margin, clad with pale tawny narrow-curved scales; bristles dark brown, six to the central lobe. Wing scales dingy black, spinose on the costa; subcosta with large triangular lateral scales and double row of smaller median; lateral scales on veins to the fourth and upper branch of fifth in shape narrow lanceolate though the ends are not pointed, but on the branches of the fork cells there are moderately long scales with nearly square ends and broader at their apex than base; bases of fork cells about level; the first cell is a trifle longer and narrower than second though owing to twisting of the wing this is difficult to determine accurately; stem of first fork cell shorter than the cell in about the proportion of four to five; posterior transverse vein about one and half times its own length from median. Coxæ light muddy-brown with silvery flat scales; under sides of the femora silvery especially well marked in the hind femora. This white is a different white to that of the scales on the pleura as it is translucent. It is a very difficult appearance to indicate by a word. Upper sides of femora and all the rest of all the legs clad with dark purple-brown scales. There are rows of pale tawny spines on the tibiæ which are much longer on the hind tibiæ than on the others. There is a narrow ring of pale tawny scales on the apex of the hind tibia. Ungues equal uni-serrate on fore and mid legs.

Abdomen.—Dorsally clad with dark purple-brown scales which in some lights shew rich blue and bronzy reflections. A band of white scales about one-third the breadth of a segment occupies the bases of the second to sixth (inclusive) segments, on the seventh there is a small central patch of

white scales but not a band. In another specimen this band is not nearly so conspicuous there being a semi-circular patch of white scales at the base of each segment which does not reach the sides. There are large basal lateral spots to each segment in both specimens and a fringe of pale tawny hairs inserted on the free margin of each. The venter is clad with greenish-brown scales with very imperfectly marked basal bands.

Occurrence.—Described from two females taken at midday in jungle near Kuala Lumpur.

Remarks.—Although I have no male I do not think there is any doubt this should come in this genus. The scale ornamentation of the head and scutellum the number of the scutellar bristles the shape of the scales on the head and wing are fairly characteristic. It resembles *A. Varietas* but the distinct dorsal banding of abdomen separates it from this and all the other species of the genus.

Aioretomyia Perdita. n. sp.

Described from one male taken at midday in the jungle Gombak Road five miles from Kuala Lumpur. Unfortunately the type is lost and the description is drawn up from recollection. There were however some very distinctive points I have described from memory and feel sure the type could be recognised from the peculiar fore ungues.

Male Head.—Dark slate-grey clad with dark purple-brown spatulate scales very broad and with rounded ends; a few dark grey narrow curved scales on the vertex and along the orbital margin of each side for about half the distance. Pale muddy-brown vertical bristle. Basal joint of antennæ pale ochraceous; second joint swollen with a projecting ridge in the middle which bears a few dark slate-grey flat scales; remaining joints banded dark grey and white. Palpi very short. Clypeus pale ochraceous. Proboscis dark scaled. Thorax light muddy-brown with dark grey patches clad with black narrow-curved scales. Scutellum with black central bristles and black narrow-curved scales. Wings dark grey with dark grey scales; lateral scales elliptical at the bases of the veins broadly clavate towards the apices; the third long vein has lateral scales in its whole length and so has the second which is not usual as the stem is generally deficient in lateral scales except just at its apex. This is a distinctly characteristic feature. Legs with pale coxæ and dark brown scales with purple reflections without bands or spots. Fore ungues unequal. The larger unguis much curved and with two long sharp spines close together near the base. Small unguis scarcely curved and with one tooth. Abdomen dark greyish-brown above and (?) with pale lateral spots and ochraceous venter. Genitalia with numerous long golden-brown hairs.

Remarks.—Though this description is necessarily very imperfect its main features are absolutely accurate and so far I have come across no mosquito it could possibly be confused with.

The head and scutellar scaling with the short male palps shew it to belong either to this genus or Aedes and the wing scales at once separate it from Aedes. No other Aioretomyia has the peculiar fore ungues of this species so that it should be easy to recognize.

Aioretomyia Ostentatio.

Of medium size with a conspicuous bright golden band down the centre of the mesonotum, a golden line running round the anterior margin of the mesonotum which bends in on each side just in front of the wings, and a spot of bright golden scales over the base of each wing, three spots on the scutellum, and a central golden line on the head; rest of the mesonotum with rich dark brown scales. Wings heavily scaled with rather broad clavate scales. Palpi proboscis and legs dark brown scaled. Abdomen with large pearly-white lateral spots.

Female Head.—Dark brown; in the centre a line of bright golden narrow-curved scales broader behind than in front, bright golden narrow-curved scales along the orbital margins, and on either side of the central line there is a triangular patch of rich purple-brown broad flat scales with rounded ends set row behind row in an imbricate manner; outside this patch is a small spot of golden flat scales succeeded by purple-brown scales, and behind on the occiput are a few rows of golden-brown upright forked scales; vertical bristles bright golden, about five in number, at their base the golden narrow-curved scales are massed and form a distinct spot; orbital bristles short, about three a side and dark brown. Basal joint of antenna light yellowish-brown with a few pale hairs and small golden scales on the inner face, second joint longer than third with a few small scales and numerous dark brown hairs, no regular verticillate hairs, remaining joints dusky-brown with pale tomentum and dark brown verticils. Facies pale yellow. Clypeus dark brown, frosted, and nude. Palpi very short about one-seventh length of the proboscis clad with dark purple-brown scales, with certainly three possibly four joints. Proboscis clad with dark scales, not more than two-thirds the length of the abdomen.

Thorax.—Prothoracic lobes very dark brown clad with small flat scales with ends slightly rounded, purple-brown in colour, and a row of dark brown bristles. Mesonotum deep brown clad with narrow-curved scales as follows: a line of bright golden scales runs round the margin of about the anterior half and ends posteriorly by bending in almost at right angles nearly to the central line, down the centre as far back as the bare space in front of the scutellum is a narrow band of bright golden scales about six scales broad, and above the base of each wing is a short line of golden scales, the rest of the mesonotum being densely clad with dark purple-brown scales (dark bronze under a hand lens). There are the usual lines of bristles and they are dark purple-brown in colour. Scutellum dark blackish-brown clad with narrow-curved scales only, of a bright golden colour, those on the central lobe being longer than those on the lateral lobes. The scales are arranged in three patches with bare space between. Bristles dark purple-brown, central lobe bristles knocked off but the scars shew the number to be four. Pleuræ dark brown with patches of racquet-shaped pearly-white flat scales. Wings brown with dark brown scales, double row of elongated spatulate median scales on all the veins but larger on the anterior veins than the posterior. The wing is very densely scaled and the lateral scales are clavate. The second long vein commences a good deal nearer the wing base than is usual; fork cells long, first fork cell about one-third the length of the wing, about twice as long as its stem, and about one-and-half times as long as the second, of about the same breadth as

second, its base much nearer the wing base; posterior cross-vein shorter than median about one-and-half times its length distant from that vein. Coxæ light or dark brown according to age of mosquito. A patch of creamy scales on the anterior face of the fore coxæ and a few scales near the base of mid coxa; femora covered above with dark brown scales; beneath they are silvery-brown, this being least marked on the fore legs most marked on the hind legs; at the apex of each is a ring of creamy scales especially well-marked on the hind femora. Tibiæ dark brown scaled with rows of pale golden spines. Metatarsi and tarsi scaled dark brown but under a 2/3 power the scaling towards the ends of the tarsi looks paler and more of a coppery-bronze. Fore and mid ungues very clumsy equal and uni-serrate. Hind equal and simple.

Abdomen.—In the living specimen curved upwards especially at the apex. Clad with metallic-purple-bronze scales above. At the base of each segment is a large patch of pearly-white scales. Ventrally each segment is basally banded with pearly-white scales though owing to retraction this is only imperfectly seen in a dry specimen. The penultimate segment is much expanded apically like a bell the genitalia corresponding to the clapper.

Occurrence.—Described from a series of females some hatched from larvæ found in a small jungle pool some caught as adults.

Remarks.—The scaling of head thorax and scutellum resembles that of other species of this genus but the wings are more heavily scaled and the lateral scales are broader than in any other species. The larva certainly resembles that larva of A. Varietas, but the discovery of a male may prove it a member of the sub-family Culicinæ. It is sylvan and a vicious day biter.

Genus 5.—**Acalleomyia.**—NOV. GEN.

Head clothed with flat scales over most of its surface with narrow-curved ones behind. Scutellum with flat scales and six border bristles; mesothorax with curved hair-like and narrow-curved scales; metanotum nude. Fork cells moderately long; first sub-marginal cell longer than the second posterior cell; many of the lateral vein scales long and broad.

Acalleomyia Obscurus. n. sp.

A mosquito of medium size with pale colourless pleura with black scaled legs and abdomen; dark slate spatulate scales on the head with a few narrow-curved ones behind and numerous upright scales. Scutellum with spatulate scales. Prothoracic lobes and pleura without scales.

Female Head.—Slate-grey, covered with dark slate spatulate scales with rounded ends over the whole of its surface except for a margin of light-grey scales along the eyes which is ill-marked at the vertex but becomes broader and more distinct laterally; on the nape scattered amongst the broad scales are some dark grey narrow-curved scales covering a patch roughly triangular; several rows of dark grey almost black upright forked scales are present and a few extend as far forward as the vertex. The head scales shew purple and blue tints in certain lights. Basal joint of antenna dark slate, hairy, but without scales, remaining joints dark slate except for a small colourless band at the insertion of each verticil. There is a fairly

dense covering of short downy white hairs to each joint; verticillate hairs black. Clypeus dark slate and nude. Palpi three-jointed, the terminal joint being club-shaped and about as long as the other two joints together, covered with dark slate or black scales with purple reflections. Proboscis as long as the abdomen, scaled as the palpi.

Thorax.—Prothoracic lobes practically colourless and translucent but in freshly hatched specimens they have the greenish tinge due to the internal contents; a few black bristles are inserted on each lobe but no scales. Mesonotum has a brown colour in some lights but in the shade it has a smoky tint due to the greenish tinge of the thoracic contents behind it; it is clad with narrow scales which are almost black though in some lights they are of a dark slate colour. These scales are arranged more or less in lines. Mesonotal bristles black. There are a few light-grey scales on the anterior margin of the mesonotum. Scutellum of the same colour as the mesonotum clad with a patch of spatulate scales on the central lobe; the lateral lobes are without scales and this is the normal condition and is not due to denudation. Scutellar bristles black, five to the central lobe in the type, six in two other specimens. Pleura translucent greyish-white without scales but with two short rows of black bristles. Wings smoky covered with dark slate-grey scales; double row of narrow median scales to all the veins and very narrow linear lateral scales on all except the subcostal. Coxæ colourless translucent with a few spatulate pale scales on the hind coxæ and blackish bristles on all. Under sides of femora silvery; the rest of each leg is clad with scales exactly the same colour as those on the proboscis and abdomen that is they are almost black in some lights with a greyish tinge in others and bronzy-purple if looked at obliquely. Hind tibiæ spinose. Ungues equal and simple.

Abdomen.—Clad with dark purple-brown scales above and pale scales below. No spots or hands.

Male.—Antennæ dusky-brown with purple-brown plumes. The palpi are peculiar in the presence of a small collar-like joint between the second and fourth or terminal joint. Fore ungues look equal both in a mounted preparation and a dry specimen. One of them is uni-serrate. The mid ungues are small and equal but not as small as the hind. One unguis bears a small tooth. The genitalia in this specimen are very complex. The basal piece supporting the claspers is roughly three-sided, one side convex the other two flat. The convex side is dorso-lateral, one flat side is ventro-lateral the other internal. At the base of the clasper on the outer side is a projection supporting a thick pointed chitinous rod which sticks up like a thorn on a branch; the apex curves downwards towards the venter and ends in a clump of thick chitinous golden-brown spines about five in number. Just behind the end a large chitinous hook is inserted which curves downwards and ends in a broad barbed arrow head. This piece projects outwards and it may be folded downwards. It works on a hinge joint in a dorso-ventral plane. The internal claspers consist of several pieces but are difficult to make out with accuracy. The ventral plate of the genital segment ends in a broad tip fringed with long hairs. The genitalia are absolutely characteristic as though species of Aioretomyia and Verrallina have also singularly complex genitalia; they are all distinct from one another and from this mosquito.

Genus 6.—**Verallina.**—*Theobald.*

Head clad entirely with spatulate and upright scales closely packed (in V. Virilis there are a few narrow-curved scales on the vertex) scutellum with narrow-curved scales. Palpi in male and female very short three-jointed in male and female. Thorax with narrow-curved scales. The larva of this species is remarkably like the larva of Aioretomyia Varietas. The Malayan species are six in number.

Verrallina Butleri Theobald.
Verrallina Virilis N. sp.
Verrallina Malayi N. sp.
Verrallina Fragilis N. sp.
Verrallina Indecorabilis N. sp.
Verrallina Imitator.

VERRALLINA BUTLERI.—*Theob.*

Head black entirely covered with small black spatulate scales closely packed except (in some specimens) for a central line of dingy-white scales and sometimes a similar line on either side. Mesonotum black with dark bronze scales. Abdomen black with ovoid white lateral spots.

Female Head.—Black clad with small black spatulate scales and a few black upright scales confined to the nape. Some specimens shew a line of dingy-white scales in the centre and on either side; it is never very conspicuous and is not always present but if present is much more conspicuous in the fresh than in the dried specimen. Basal joint of antenna deep brown, remaining joints blackish-brown with blackish-brown verticils. Clypeus black. Palpi and proboscis clad with black scales. Palpi three-jointed.

Thorax.—Prothoracic lobes deep brown with a few scales and bristles of a similar colour. Mesonotum black with a dense covering of dark bronze narrow-curved scales. Scutellum black with black narrow-curved scales and black bristles of which there are six to the central lobe. Pleuræ blackish-brown with patches of silvery scales. Wings with dark brown scales the median short clavate the lateral longer and slightly clavate especially towards the apex of the wing; fork cells of equal breadth, the first longer than the second, its base nearer the wing base, its stem about quarter the length of the cell; posterior cross vein rather more than its own length from the median. Coxæ deep brown; femora black above pale beneath; remainder of all legs clad with black scales.

Abdomen.—Clad with black scales and white lateral spots.

Male.—Antennæ plumose; the basal joint is deep brown and without scales, the remaining joints are banded white and brown and the verticillate hairs are light olive-brown. Palpi very short three-jointed. The wings are more lightly scaled than those in the female. Fore ungues markedly unequal the larger unguis uni-serrate, the mid ungues unequal but not so much so as the fore, and the larger unguis uni-serrate; hind ungues equal and simple. Genitalia complex there being two pairs of claspers one of which consists of two chitinous hooks.

Occurrence.—The commonest mosquito in the mangrove swamps. Larvæ were found in brackish pools in the mangrove.

Remarks.—The male is described here for the first time. It is easily recognised though not at all unlike *Stegomyia fusca* which is common in similar situations but from this it is at once distinguished by the scutellar scaling and in the male the short palpi. The scutellar bristles vary in number from four to six the latter is however the more usual number.

Verrallina Virilis. n. sp.

Head clad entirely with small flat scales with rounded ends purple-black with some paler ones at the sides and on the nape. Thorax light brown with narrow curved scales golden in front on the margin, black elsewhere. Legs unbanded clad with brown scales. Abdomen with lateral white spots.

Male Head.—Blackish-brown; a bare line in the centre, on the vertex a few pale golden narrow-curved scales, pale spatulate scales along the orbital margins and a very ill-defined area at the side clad with pale scales; the rest of the head covered thickly with purple-black spatulate scales with rounded ends and on the nape there are a few rows of dark upright forked scales and in certain lights some of the flat scales in this region are pale having a washed-out appearance. Basal joint of antenna light muddy-brown, without scales, second joint swollen and ridged on its inner face where a few dark scales are inserted, remaining joints white at the base, dusky-brown at the apex except the two last which are entirely dusky; plumes long silky-purplish-brown. Clypeus brown. Palpi slender, about twice as long as the clypeus and apparently composed of two (? three) joints; very lightly scaled with dark brown scales. Proboscis nearly as long as the abdomen, clad with dark purple-brown scales.

Thorax.—Prothoracic lobes dusky-brown, apparently without scales but with a row of dark brown bristles. Mesonotum light brown, clad with narrow-curved scales which on the margin in front are golden but elsewhere black with pale brown ones interspersed; bristles dark purplish-brown. Scutellum brown with a purple tinge clad with pale brown narrow-curved scales and with five dark brown bristles to the central lobe. Pleuræ pale muddy-brown with patches of pale scales which in parts take the colour of their background, there are also rows of light yellowish bristles. Wings brown with dark brown scales spinose on anterior edge of costa large and spatulate on subcosta; second vein very distinct and ending near wing apex; lateral scales only present on anterior edge of first vein, branches of first fork cell and scantily on third vein; fork cells of equal width, first longer and its base nearer wing base; median cross-vein longer than the posterior cross vein, distant from the latter by twice the length of posterior vein. Coxæ muddy-white; fore coxæ with dark brown scales in front; femora with dark brown scales above and silvery scales beneath and in the hind legs at the sides; a ring of spines round apex of femora of fore leg and short spines on each femora; tibiae spinose and with dark brown scales; metatarsi and tarsi with dark brown scales; fore and mid ungues unequal the larger unguis uni-serrate. Metanotum light brown, two black chætæ at the base.

Abdomen.—With dark purple-brown scales above, large quadrilateral white patches at the base of each segment laterally. Genital segment enlarged. Dorsal sclerite elongated backwards forming a plate arching over the claspers; it is concave below, convex above, concave on each side, and each lateral angle is prolonged forwards as a sort of horn. Each clasper consists of three pieces a basal piece and two apical pieces hinged to this; the basal is concavo-convex the convex surface being outwards the edge between the two being continuous with the lateral edge of the dorsal sclerite. The anterior hinged piece consists of a dark brown chitinous rod which terminally is split into four blunt teeth. The posterior piece is a sickle-shaped blade flattened antero-posteriorly; from the base of each basal portion a straight needle-like pointed rod projects backwards beneath the dorsal plate and possibly represents the internal claspers.

Occurrence.—Described from one male taken at mid-day in the jungle a few miles from Kuala Lumpur.

Remarks.—Resembles *V. Malayi* in many points but is evidently distinct.

Verrallina Malayi. n. sp.

Head with spatulate scales and a few purple-bronze upright forked scales on the central area, a well marked stripe of creamy scales at the sides. Thorax brown with a purple tinge in some lights, with bronzy scales. Scutellum with narrow scales. Under sides of femora silvery. Legs and abdomen dark purple-brown; abdomen with large lateral spots. *All* the ungues uni-serrate in the female.

Female Head.—Covered above with dark purple-bronze scales which are limited laterally by a well-marked band of silvery scales which have a slightly yellowish tinge; this is succeeded by dark scales. A few dark brown short upright forked scales are inserted low down on the nape. Antennæ broken. The basal joint is dark brown with a few dark brown scales on its inner face; the second joint is also dark brown. Cypeus dark brown, nude. Palpi apparently three-jointed clad with dark purple-brown scales and some long dark brown hairs. Proboscis shorter than the abdomen clad with purple-brown scales.

Thorax.—Prothoracic lobes dark brown with a row of dark brown bristles and some flat silvery scales. Mesonotum brown with a purple tinge in certain lights, the sides are rather more yellowish-brown than the centre; there are three ill-defined darker brown lines in the centre in front, the two lateral ones turn outwards about half way across the mesonotum; thinly clad with narrow-curved scales which vary with the light from a dark brown to a pale fawn-brown or light bronze. The mesonotal bristles are dark brown. Scutellum brown, with narrow-curved scales, dark, or lighter brown, according to the light; at the base of the central lobe mingled with the narrow-curved scales are a very few narrow spatulate scales. These are very difficult to see as they lie close to the scutellum and take its colour, but they are quite distinct if looked for carefully. Pleuræ light muddy-brown with one or two darker patches, and three distinct patches of silvery-white spatulate scales and a few dark brown bristles. Wings smoky with dark brown scales, a few small spinose scales on the anterior edge of costa, a double row of median scales on first vein, and linear lateral ones on either margin

of the apical half; lateral scales on the branches of fork cells linear except just at the apex where they are very slightly enlarged at the ends; third vein with lateral scales of similar type; first fork cell longer and narrower than second, its stem about two-thirds its length, its base nearer wing base supernumerary and median cross veins almost in a line, posterior distant twice its length from median. Coxæ light muddy-brown, fore and mid with scales and hairs. Femora scaled dark brown above silvery below with two rows of pale golden short spines; tibiæ with dark brown scales metallic-purple in some lights with pale golden-brown spines very long on the hind legs; metatarsi and tarsi scaled as the tibiæ. Ungues on all the legs equal each with a small tooth, a most unusual condition, the hind ungues in nearly all mosquitoes being simple.

Abdomen.—Clad with dark brown scales with purple reflections and broad white basal spots. Venter retracted.

Occurrence.—Described from one female taken in jungle off the Gombak Road Kuala Lumpur.

Remarks.—Possibly the female of *V. Fragilis.*

Verrallina Fragilis. n. sp.

Head clad with spatulate brown scales with metallic-bronze and purple reflections. Thorax dark brown. Palpi minute, clad with dark brown scales as is the proboscis. Legs with dark brown scales. Abdomen dark brown with lateral patches of silvery scales.

Male Head.—Light brown clad with spatulate scales with rounded ends which are olive-brown with bronze-purple reflections, those at the sides appearing rather lighter, especially one small semi-circular patch close to the orbital margin; there are a few dark brown upright forked scales on the nape. Orbital bristles olive-brown. Basal joint of antenna dark brown, apparently without scales or hairs, second joint slightly swollen and ridged with a very few small spatulate scales on its inner side, remaining joints banded brown and white. Plumes olive-brown silky. Clypeus dark brown. Palpi three-jointed, last joint sub-ovate, as long as the first two joints together, clad with purple-brown scales. Proboscis not as long as the abdomen, clad with dark purple-brown scales.

Thorax.—Prothoracic lobes brown, with a row of dark brown bristles and some spatulate silvery scales. Mesonotum brown, clad with lines of narrow-curved scales which look dark brown in a poor light, light bronze-brown in a good light; bristles dark brown. Scutellum resembles the mesonotum in colour and scaling. Pleuræ muddy-brown, clad with patches of silvery flat scales. Wings smoky, clad with brown scales, spinose on the anterior edge of costa, lateral scales for the most part linear but those on the first fork cell slightly broader at the apex than at their base; first fork cell rather longer than its stem and a little longer than the second though of the same breadth; posterior cross vien about twice its length from median. Coxæ light muddy-brown with flat silvery scales on the fore and mid; all the legs clad with dark brown scales with bronze and purple reflections, the under sides of femora being clad with pale scales. Fore and mid ungues unequal, the larger ungues uni-serrate.

Abdomen.—Clad with purple-brown scales above, with spots of silvery scales laterally and with pale scales on the venter. Genitalia. The eighth segment consists of a dorsal and ventral flap which flaps partially overlap and conceal the ninth or genital segment. The ventral flap is fringed with short golden-brown stiff spines which point directly backwards. The ninth segment consists of a chitinous plate above a swollen globose ventral portion and the genital lobes between. Each genital lobe has three surfaces one looking inwards parallel to its fellow of the opposite side, one convex looking upwards and outwards and one concave looking downwards and outwards; on the apex of each is a conical chitinous clasper broad at the base with a triangular transverse section flattened from side to side at its apex and barbed on the upper edge, the under edge having a double curve. At rest this process points ventralwards. Inserted more externally but still on the apex of the genital lobe is a chitinous process round in section at first then becoming flattened from side to side and broadening out and from the lower angle of this a curved hook passes in a plane at right angle to the plane of the broadened-out portion. The other angle ends abruptly in a point. Internal to both lobes that is between the two and on the ventral aspect is a double curved long chitinous internal clasper pointed at its end and between these two, sharp, spine-like pieces project which are probably part of the penis.

Occurrence.—Sylvan; caught in the jungle near Kuala Lumpur.

Remarks.—Though this mosquito is described under a separate name it is quite possible it will prove to be the male of *Verrallina Malayi* or *Imitator* the noticeable difference being the presence of well-marked lateral abdominal spots in the above and their absence in Malayi and Imitator. As they were not taken in the same place they may be distinct.

Verrallina Indecorabilis. n. sp.

Head dark with black-brown scales paler along orbital margins and at the sides. Thorax muddy-brown with pale purple-brown narrow scales. Abdomen and legs with dark brown scales without bands or spots. Ungues on all the legs of male and female uni-serrate.

Female Head.—Clad with dull black or blackish-brown scales with purple reflections in a good light; along the orbital margin and at the sides there are paler scales contrasting but feebly with the darker ones and looking as though they were the darker scales faded. Basal joint of antenna pale ochraceous, nude; remaining joints dull black with colourless rings at the bases; verticillate hairs black. Clypeus dark brown. Palpi with dark brown scales; about twice as long as the clypeus and about one-sixth the length of the proboscis. Proboscis dark brown about as long as the abdomen.

Thorax.—Prothoracic lobes brown, unscaled. Mesonotum muddy-brown with numerous long bristles and sparsely clad with narrow-curved dark brown scales with a purple tinge. Scutellum brown with a few brown narrow-curved scales, with four bristles to central lobe. Pleura pale muddy-yellow with a few dull white scales. Wings clad with dark brown scales which where massed as on the costa are distinctly purple; fork cells long, first longer, but not narrower than the second, about twice as long

as its own stem, its base nearer wing base than the base of the second; posterior cross vein about one-and-half times its own length from median. The lateral vein scales are linear towards the bases of the veins but towards the apices they become distinctly clavate; on the branches of the first fork cell the median and lateral scales are similar but on third and subsequent veins the median scales are shorter and broader than the lateral. Coxæ pale muddy-white. Under sides of femora dingy-white especially marked on the hind femora; remainder of all legs clad with dark brown scales with coppery and purple reflections. Ungues of all the legs equal and uni-serrate.

Abdomen.—Clad entirely with dark brown scales with purple reflections in some lights; the venter has a dingy-white appearance.

Male.—With very short palpi and plumose antennæ the plumes silky-purple-brown. Fore and mid ungues markedly unequal the larger unguis uni-serrate. Hind ungues equal and each unguis uni-serrate. Genitalia have exactly the appearance of the jaws of a pair of tooth forceps the claspers being apparently soldered to the genital lobe and consisting of a stout dark brown chitinous bar with hollow on its inner face the end truncated and slightly notched. There are apparently a pair of very small internal clasper curving downwards.

Occurrence.—Bred from larvæ taken in a small jungle pool near Kuala Lumpur.

Remarks.—Very similar to *V. Imitator* but the wing scaling is heavier the fork cells longer and the colours duller and more black. From *V. Malayi* it is distinguished by the absence of abdominal lateral spots and the colour of the head scaling. The genitalia of the male are very different from those of *V. Fragilis* and *V. Virilis*.

Verrallina Imitator. n. sp.

Head clad with dark brown scales with purple reflections above and a pale band at the side difficult to see and not very well marked. Thorax brown with narrow-curved scales dark brown in shade, pale brown in a good light. Legs unbanded clad with dark brown scales. Abdomen with dark brown scales without bands or lateral spots.

Female Head.—Clad above with not very dark purple-brown spatulate scales and at the sides with pale silvery scales. The line of demarcation between dark and light scales is not nearly so well defined as usual it being a little difficult to see where each colour begins or ends the line between shifting as the angle of light varies. There is a narrow band of pale scales along the orbital margin and a few dark brown upright forked scales on the nape; vertical and orbital bristles dark brown. Basal joint of antenna light muddy-yellow with darker shading on the inner surface and a few hairs but no scales, second joint yellowish at the base, dark brown at the apex; remaining joints dark brown with numerous silvery hairs and brown verticillate hairs with pale tips. Clypeus brown and nude. Palpi apparently three-jointed, short, and clad with dark purple-brown scales. Proboscis about two-thirds length of the abdomen clad as the palpi.

Thorax.—Prothoracic lobes brown, with dark brown bristles and a few silvery flat scales at the apex. Mesonotum brown with dark brown bristles and lines of narrow-curved scales which vary with the light from dark brown to a pale fawn-brown. Scutellum brown with scales similar to those on the mesonotum; only four bristles to the central lobe. Pleuræ brown, with patches of flat silvery scales. Wings smoky, clad with dark brown scales, spinose on the anterior edge of costa; subcosta and second vein well separated, the latter, with double row of small spatulate median scales in its whole length and lateral scales on the apical half; all remaining veins with small single row of median scales, and all except the sixth with lateral scales which are almost linear in shape except at the vein apices where they become very slightly enlarged at their ends. Legs pale and ochraceous with a silvery sheen; fore coxæ with silvery and dark brown flat scales; fore and mid femora with dark brown scales above and silvery scales below and at the sides; hind femora with pale translucent silvery scales on the basal half and below on the apical half, dark brown scales above on the apical half; remainder of all legs clad with dark brown scales with purple reflections. All ungues equal and uni-serrate a very unusual condition.

Abdomen.—Clad with dark brown scales and without lateral spots.

Occurrence.—Described from two females taken in a patch of jungle on the Gombak Road five miles from Kuala Lumpur. The specimens are somewhat damaged but are clearly distinct.

Remarks.—This mosquito somewhat resembles the *V. Indecorabilis* but the wing ornamentation should at once distinguish it. But it is possible Fragilis is the male of this species as the scaling of the head closely resembles this specimen but *Verallina fragilis* has distinct abdominal spots and differs in some minor points which have led me to describe it as a separate species. There is great difficulty in determining the male of any particular species in this and allied genera as the males resemble one another so closely except in the matter of genitalia it is almost impossible to say which is the male of any particular female by inspection only.

Genus 7.—**Mimomyia.**—*Theobald.*

This genus is apparently unrepresented here but the genera Conotiomyia Dasymyia and Eterleptiomyia have certain points of resemblance. Mr. Theobald has placed this genus in the sub-family Aedeomyina but the male palpi though not as long as the proboscis are certainly much longer than that of any species belonging to any one of the genera of this sub-family. In the genus Dasymyia the males have palpi and proboscis identical with those figured by Mr. Theobald in an article by him in "First Report of the Wellcome Research Laboratory Khartum," published 1904, as those of a male Mimomyia and I have placed my genus Dasymyia in the sub-family Culicina as in my opinion its affinities are more with certain genera in that sub-family than they are with members of any of the genera in Aedeomyina.

See under "Remarks" of the genera Conotiomyia, Etoleptiomyia and Dasymyia.

Genus 8.—**Uranotaenia.**—*Theobald.*

Characters.—Head with racquet-shaped and upright scales only. Thorax with narrow-curved and fusiform or elliptical scales the narrow curved being inserted on the dorsum and the others on the margin. Scutellum with racquet-shaped scales. Wings with extremely short fork cells and clad with unusually large scales the lateral fusiform the median either spatulate or cordate. Male proboscis enlarged apically and hairy. Mid ungues of male markedly unequal the larger unguis usually much curved.

Remarks.—Most of the members of this genus with spotted wings have been separated off as a distinct genus by Theobald quite recently on account of certain peculiarities of the mid ungues of the male. But as this peculiarity is difficult to see and does not appear to me of sufficient imporance to constitute a new genus, the various members agreeing in all other important characteristics I have retained the old classification. The species fall into two natural groups, the first containing all those shewing azure-blue lines on head thorax and pleura the second the dull-coloured species usually clad with brown scales and of larger size. The main characteristics of the genus are well developed in all the species, the wing scaling and venation being very typical. The larva is also very characteristic the position being horizontal to the surface film but beneath it the respiratory tube short and the head conical and in shape resembling the anopheline larva.

Synoptic Table of Species.

A. Wings spotted. Proboscis banded.

(*a.*) Costa spotted. Femora and tibiæ of mid and hind legs banded as well as the tarsi. Last tarsal joints of mid and hind legs pure white.....U. Trilineata.

B. Wings spotted. Proboscis self-coloured.

(*b.*) Two black spots confined to the costa and second vein. Banding confined to the tarsi.....U. Micans.

(*c.*) One long black spot on costa with a short second spot which passes as a band right across the wing. Bands confined to the hind leg. Last two tarsal joints of the hind leg pure white.....U. Bimaculiala.

(*d.*) One long black spot on costa which at its apical third passes right across the wing. Leg banding absent except for white scaling of last two joints of hind leg.....U. Unimaculiala.

(*e.*) A long black basal spot on costa and adjoining vein, which apically passes across the wing as a band. A broad band of silvery scales along the margin of mesonotum. Last two-and-half tarsal joints of hind leg creamy.....U. Nivea.

C. Wings and proboscis self-coloured.

(*f.*) Legs unbanded. Two blue lines crossing pleura one being at margin of mesonotum. Abdomen banded.....U. Campestris.

(*g.*) Last three tarsal joints of hind leg white. Third and fourth abdominal segments with broad white bands dorsally.....U. Argyrotarsis.

(*h.*) Legs and abdomen entirely without bands or spots. Blue line crossing the pleura and one on the margin of mesonotum.....U. Cancer.

(*i.*) Proboscis very long. One broad ventral band about the middle of the abdomen. Legs and dorsal surface of abdomen unbanded.....U. LONGIROSTRIS.

(*j.*) Legs and abdomen unbanded. A silvery margin to the mesonotum.....U. MODESTA.

(*k.*) Thorax almost black abruptly separated from the silvery pleura by a line of silvery scales on the margin....U. NIVIPLEURA.

(*l.*) Thorax reddish-brown, one blue line across the pleura and blue scaled lines on the head. Legs and abdomen unbanded.....U. UNILINEATA.

D. General colour dark brown with or without dull yellow abdominal bands. Of somewhat more robust build than the foregoing species.

(*m.*) A rather large species of generally brown colour with a silvery line on the margins of the mesonotum.....U. MAXIMA.

(*n.*) A dull-coloured species with dull yellow abdominal bands and light yellowish thorax.....U. LUTESCENS.

(*o.*) Of a general reddish-brown colour without ornamentation. Pleura light yellow with thin dark brown spots .....U. MACULIPLEURA.

(*p.*) A large species with brown thorax and dark brown abdomen marked with dull creamy bands.....U. BICOLOR.

(*q.*) A blackish-brown species with a large eye spot on either side of the mesonotum in front of each wing-root...U. BIMACULATA.

(*r.*) A small dull-coloured species absolutely destitute of any ornamentation.....U. FUSCA.

URANOTÆNIA TRILINEATA. N. SP.

Thorax dark brown almost black covered with dark brown narrow-curved scales and having a bluish-white line of flat scales running round the margin of the anterior half and two similar lines crossing the pleura. Wing with a long and short dark scaled area on the costal margin. Proboscis alternately brown and white scaled above. A line of bluish-white scales running the whole length of the lateral surfaces of the mid femora and a white patch at the apex of the upper surface of each. Hind femora with lateral white lines and apical white spot ; tibia with three white bands ; metatarsus with a creamy band a little way from its base and another at the apex. Two first tarsal joints with creamy apical bands last two entirely creamy.

Female Head.—A tuft of very long snowy-white linear scales on the vertex, projecting forwards ; running backwards from this on either side with an outward curve is a line of bluish-white racquet-shaped scales which ends in a patch of similar scales in front of the occipital foramen. The space between these lines is clad with dark brown racquet-shaped scales having a purple tint in a good light. Outside the blue lines the scaling is also dark brown ; numerous dark brown upright forked scales can be made out over the central patch extending forwards almost to the vertex. The orbital bristles are dark brown. Basal joint of antenna dark brown, almost black, with a few small scales on the inner face very difficult to see as they take the colour of their background ; second joint a little longer than succeeding, but not as long as two, with scattered dark brown hairs and a ring of verticillate hairs ; remaining joints blackish-brown with numerous silky-white

hairs. Verticillate hairs dark brown. Clypeus almost black with a frosty tomentum. Palpi minute closely applied to the clypeus, brown in colour (but whether this is due to scales or is the colour of the palpi itself I cannot say) hairy. Proboscis about as long as thorax and abdomen together enlarged gradually at the apex ; on the upper surface the scaling is bluish-white for the first two-thirds then black for a short distance, then bluish-white again, then black at the base of the labellæ which are reddish-brown ; beneath and laterally the scales are black.

Thorax.—Prothoracic lobes dark umber-brown; running obliquely across each lobe is a line of bluish-white scales which forms one line on either side with the bands on the head and middle of the pleuræ. This peculiar setting of the head is due to the high arching of the mesonotum which projects forwards the head is pushed downwards and its upper surface instead of looking upwards and backwards looks almost directly forwards thus the proboscis is carried at right angles to the body, and the band of white scales present on the heads of so many members of this genus comes to lie in a horizontal plane and always forms one line with that on the prothoracic lobes and pleura. Mesonotum dark umber-brown ; running round the margin of the anterior half from wing to wing is a bluish-white line composed of a single row of scales which are spindle-shaped near the wings shorter and more circular towards the front ; the rest of the mesonotum is thickly clad with dark brown narrow-curved scales and numerous stout dark brown bristles ; there are a few paler brown scales scattered among the others. Scutellum dark brown with a paler brown margin clad with dark umber-brown spindle-shaped scales ; central lobe with four dark brown bristles. Pleuræ dark brown, crossed horizontally about its centre by a bluish-white line composed of a row of racquet-shaped scales ; below this is a second shorter line but the scales composing it are really inserted on the coxæ. There are the usual bristles which are dark brown. Costal margin of wing with two dark scaled areas, one involving the basal half of the costa and portions of subcostal and first long veins posterior to it, the other lies near the apex and also involves the first and second long vein and reaches to a point opposite the base of first fork cell ; the median scales on the basal half of the third vein are dark brown and most of those on the upper branch of the fifth ; the rest of the scales vary in colour as the direction of the light is altered being sometimes light silvery-brown and again bluish-white. The wing scales are large, the median being broad spatulate, many with oblique ends, the laterals are large fusiform scales and are only present on branches of the fork cells and the third long vein ; the fork cells are very short, the first is shorter than the second and closely applied to the margin of the wing ; base of second cell much nearer wing base ; posterior cross vein a little more than its own length from the median. Coxæ brown ; at the level of the insertion of the coxæ there is a line of broad bluish-white scales. These scales are racquet-shaped and massed in four spots one on each coxa and one between the fore and mid coxæ on the pleura. Under a hand lens these spots look like a line as the interspaces are too small to be seen. There is also a row of dark brown bristles on each coxa and a spot of white scales on the front of each fore coxa. In the fore leg the femora is clad with dark brown scales and a line of white scales either beneath or on the posterior surface but the leg has so twisted in drying as to make it difficult to decide ; there

is also a spot of white scales at the junction of the middle and apical thirds, and another patch on the upper surface of the extreme apex; the rest of the leg is clad with coppery-brown scales. In the mid leg the femur is enlarged, clad with dark brown scales with a line of bluish-white scales running down the lateral surfaces and a patch of similar scales at the apex, beneath, the scaling is paler; the rest of the leg resembles the fore leg. In the hind leg the femur is clad with dark brown scales and a line of white scales on the anterior face and two patches of similar scales towards the apex, one being on the apex; tibia with dark brown scales and three bands of creamy scales which do not involve the under surface, one near the base one about the middle the other at the apex; metatarsus dark brown scaled with a central and apical creamy band; two first tarsal joints dark brown with apical creamy bands, two last entirely clad with creamy scales.

Abdomen.—Clad with dark purple-brown scales with large patches of white scales varying somewhat; on the first three segments a large central dorsal patch at the apex, on the fourth segment the white scales cover the whole dorsum and the apical portion of the lateral and ventral surfaces, fifth segment shews a small dorsal patch of white, sixth an apical ring of white scales.

The male differs in having plumose antennæ and unequal simple mid ungues. The scaling resembles that of the female.

Occurrence.—Adults taken in the neighbourhood of jungle pools and in the quiet pools at the edges of jungle streams the larvæ are to be found.

Remarks.—The most easily recognized of all the species as it is the only Uranotænia with a banded proboscis.

Uranotænia Micans. n. sp.

Thorax light muddy-brown clad with dark brown narrow curved scales and lines of long dark brown bristles. A line of bluish-white racquet-shaped scales on either margin in front of the wings. Beneath this on either pleura is a line of similar scales which commences in a patch of such scales above the hind coxa and passes forwards towards the upper line and crosses the prothoracic lobe obliquely upwards and forwards. On the head on either side there is a line of similar scales meeting the pleural and joining its fellow on the vertex. There are two black spots on the costal margin of the wing. The first three or four segments of the abdomen shew apical white bands and the tarsal joints of the hind legs are basally banded white. The male proboscis is expanded at the apex and very hairy. The male antennæ are plumose but there is less difference between the antennæ of the two sexes than is usual.

Female Head.—Dark grey with a suspicion of brown clad with racquet-shaped and upright forked scales. On the vertex projecting forwards is a tuft of long flat white clavate scales, diverging from this are two lines of bluish-white scales which after curving a little outwards run backwards and outwards and then backwards and inwards to the lateral margin of the occipital foramen. The space enclosed by these two lines is more or less flask-shaped the neck of the flask being formed by the tuft of long scales on the vertex and is entirely clad with scales which under a hand lens appear velvety-black but in a good light olive-brown in front dark cobalt-blue

behind. The upright forked scales are very few in number and owing to the extreme shortness of the neck and the arching of the mesonotum forwards they are almost impossible to see without dissection. The lateral scales outside the bluish-white lines are deep blue or dark brown varying with the light. Vertical and orbital bristles black. Basal joint of antenna ferruginous with a few white narrow-curved scales on the inner face, second joint as long as the two succeeding joints dark brown in colour with some blackish-brown hairs there being two especially long ones on the external face just before the verticil, remaining joints blackish-brown clad with numerous short dark and pale hairs; verticillate hairs dark brown. Clypeus dark reddish-brown, frosted above, naked. Palpi extremely short and closely applied to the clypeus beyond which they do not extend, hairy and clad with dark brown scales. Proboscis nearly as long as the whole body, enlarged apically, clad with dark brown scales which have a metallic-bronze appearance in an oblique light. The enlargement involves about one-eighth of the total length and on the under surface are much longer than those on the rest of the proboscis. There is a row of short hairs on the upper surface on either side of the middle line on the enlarged portion and two rings of white hairs are in front of the other at the apex and another ring of white hairs round the base of the labellæ which are very acuminate.

Thorax.—Like other Uranotæniæ the thorax is very much arched and the mesonotum projects further forwards than in other mosquitoes and this alter the pose of the head the vertex looking forwards instead of upwards. Prothoracic lobes muddy-brown crossed obliquely from above downwards and backward by a line of blue-white racquet-shaped scales which are in one line with similar scales on the head and the pleura. Above and below this line the scales are pale and take the colour of the background. There are some dark brown bristles inserted on the apex and in front. Mesonotum light muddy-brown ; on either lateral margin a line of blue-white racquet-shaped scales which extends forwards from the root of the wing to a little short of the anterior margin. The entire space between these lines is covered with dark brown narrow-curved scales a higher power reveals some grey scales interspersed. The bristles as in most of these small uranotæniæ are of unusual length. They are dark brown in colour. The anterior marginal are particularly long and numerous. The præscutellar are grey in colour. Scutellum similar in colour to the mesonotum; central lobes clad with broad spindle-shaped dark brown scales (in mass they appear almost black) the lateral lobes with dark brown broad linear scales with truncated ends. Scutellar bristles long and dark brown. Pleura muddy-brown but paler than the mesonotum (it gets much darker in dried specimen) crossed by a line of blue-white racquet-shaped scales continuous with those on prothoracic lobe and ending behind in a patch of similar scales above the hind coxa; there are also a few bristles. Wings with costa armed on its anterior edge with spinous scales, black opposite the black scaled areas, creamy-yellow opposite the white. The scales on the costa are broad racquet-shaped and are dark brown on the basal half then bluish-white then dark brown then bluish-white to the apex. The colour of the scales on basal half varies being sometimes broken by white. The subcostal and first long veins are scaled blue-white for the first third of the wing, then dark brown, then blue-white to a little

beyond the junction of subcosta with costa, then the first long vein is black scaled nearly to its end; second long vein is brown scaled at the base and opposite the brown scales on costa and subcosta; it thus forms with the previous veins two well-marked costal spots the first of these is longer than the second and begins about the junction of basal and median thirds. There is a line of dark brown scales on the third vein near its base and another on the stem of the fifth and one on its upper branch and a patch of black scales on the sixth vein; all the rest of the wing is scaled with bluish-white scales when seen by reflected but viewed by transmitted light the scales are almost transparent. The median scales are for the most part broad spatulate scales with slightly oblique ends the laterals are the large spindle-shaped scales characteristic of this genus and only present on the branches of the fork cells and the third long vein. The dark brown scales are all median. Coxæ light brown with a silvery sheen when dry clad with a few bristles but without scales; femora pale scaled beneath, clad with dark brown scales above and laterally (these scales are purple in some lights) fore and mid tibæ and metatarsi and tarsi dark brown scaled; hind tibiæ and metatarsi also clad with dark brown scales but all the tarsal joints have a broad creamy band at their base the last being all creamy-scaled except for a patch of purple-brown scales above at the tip. These creamy scales become very dingy in the dried specimen but are always distinct. This mosquito is really a very beautiful one when alive but the scales lose lustre after death. Ungues equal and simple.

Abdomen.—Dorsally clad with dark purple-brown scales. Some of the basal segments shew apical white banding which though distinct in the fresh specimen becomes far less so in the dried. The venter is pale scaled.

Male.—Head scaled as the female. Antennæ plumose, basal joint dark brown; a white band at the apices of all the other joints but the last. Verticillate hairs purple-brown. Proboscis very long; the apical fourth is enlarged and generally bent backwards (the whole proboscis being carried at a right angle to the body) and clad with long hairs on the upper surface. The scales on the proboscis are dark brown with purple reflections as in the female. In all other respects the male resembles the female except that the mid ungues as in most members of this genus are unequal, one of the claws being much larger than the other and much curved.

Occurrence.—Described from a series caught near water in open marsh land.

Uranotænia Bimaculiala. n. sp.

Thorax brown clad with dark scales and bristles and shewing a bluish-white line in front of the wings and another crossing the pleura about mid way. Head with two bands of bluish scales diverging from the vertex with dark scales between. Wings with a long dark scaled area on the costa followed by a short white spot and then a dark spot. First and second hind tarsal joints basally banded with creamy scales last two joints completely clad with creamy scales.

Female Head.—A tuft of long blue scales on the vertex two lines of bluish-white racquet-shaped scales passing backwards to the occipital foramen diverging as they go; space between and on the outer side of each

lad with dark purple-bronze scales. I can detect no upright scales. Vertical and orbital bristles dark brown. Basal joint of antenna light rown with a few hairs on upper edge of the inner face, second joint dark rown as long as any two succeeding joints, clad with short and long hairs ut not arranged in a definite ring, remaining joints dark brown with dark rown hairs having pale tips. Verticillate hairs dark brown with pale tips. lypeus light brown, without scales, closely embraced by the palpi. Palpi inute, hairy, clad with dark brown scales. Proboscis about as long as orax and abdomen, apical fifth enlarged, the whole clad with dark brown cales with purple reflections.

Thorax.—Prothoracic lobes brown clad with broad bluish-white scales hich make one line with the bands on the head and pleura. There is also line of bristles inserted on each lobe. Mesonotum brown, with darker rown markings, and an ill-defined central dark brown stripe; on either ateral margin there is a bluish-white line in front of the wings composed of single row of scales which stand out from their points of insertion. hese scales are spindle-shaped near the wing but at the other end they ecome short and almost circular; the dorsum is clad with narrow-curved cales dark brown with paler tips. The mesonotal bristles are unusually ong and stout. Scutellum dark brown, clad entirely with dark brown mall racquet-shaped scales. Pleura brown crossed by a bluish-white line f broad scales about the centre. Wings clad with dark and light brown cales. In the living mosquito the light scales have a silvery-blue colour ut if a wing be mounted dry and viewed with transmitted light the light cales appear light brown. The costa has almost black spinose scales on ts anterior edge. The median scales on the basal half of the costa the ortions of the subcosta and first vein that lie posterior to this are dark rown almost black and form a long dark band on the anterior edge of the ving. A second but much shorter dark scaled area is formed by dark scales t the end of the first long vein and the portion of costa anterior to it. All he veins after the first have a single row of broad median scales and the ranches of the fork cells and the whole of the third vein have in addition rregular spindle-shaped lateral scales. There may be one or two lateral cales at the apices of the branches of the fifth vein. Coxæ muddy-white pparently clad only with bristles. Femora clad above and laterally with lark purple-brown scales, pale beneath; mid femora swollen; the rest of the ore and mid legs dark brown scaled. Hind tibiæ and metatarsi clad with lark purple-brown scales, first tarsal joint with a very imperfect creamy asal band, second with a well marked creamy basal band and a small pical band, third and fourth entirely clad with creamy scales. Ungues imple and equal.

Abdomen.—Clad above and laterally with dark purple-brown scales. Ventrally the scales are paler and there are apical bands of dingy-white cales.

Male.—The male has a tuft of pale blue lanceolate scales on the vertex nd running backwards from this on either side is a line of racquet-shaped ale blue scales which is convex outwards hence it encloses an oval space lad with rich purple-bronze racquet-shaped scales which in some lights re deep blue; rest of the head clad with dark purple-bronze scales. Basal

joint of antenna deep brown, remaining joints light brown with dark brown plumes. Mid ungues unequal but simple. In all respects the male is ornamented like the female.

Occurrence.—Described from a series caught in the neighbourhood of silent jungle pools either on the surface of the water or settled on living or dead leaves at the edges. The male was taken in the jungle at Raub.

Remarks.—Resembles Uranotænia Unimaculiala but is at once distinguished from it by the wing marking there being two costal spots, and the banded hind tarsi.

Uranotænia Unimaculiala. n. sp.

The head has two bluish-white lines meeting on the vertex and forming a V between the arms of which is a patch of purple-bronze scales and on either side similar coloured patches. The proboscis is unusually long. The wing is very characteristically marked: the costa and first vein are scaled with dark brown scales for about three-fourths of their length and this dark scaling extends as a band across the wing beyond its centre. The abdomen and legs are dark brown.

Female Head.—On the vertex is a tuft of long bluish-white scales and running backwards from this on either side is a band of broad racquet-shaped scales of the same colour. These bands pass backwards diverging as they go to the margin of the occipital foramen. They vary much in width in different specimens. In the one described they form a V with its apex at the vertex and the space between the arms covered with purple-bronze scales, but in other specimens the blue scales cover the larger part of the upper surface of the head leaving only a small portion on the nape clad with dark scales. Outside the blue bands the head is clad with dark purple-bronze scales. I can detect no upright forked scales on the type but on another specimen where the head is bent more downwards a few small dark brown upright scales can be seen. There are two long dark brown vertical bristles and three or four orbital bristles of a similar colour. Basal joint of antenna brown with (on the inner side) a row of rather stout bristles which curl upwards and outwards, second joint light brown as long as any two of the succeeding joints bristly all the way up and without a definite ring of verticillate hairs, remaining joints brown with a ring of short stout hairs at the apex of each the dark brown verticils being basal. Clypeus brown, nude. Palpi minute, clad with brown scales and numerous dark bristles. Proboscis very long fully quarter its length longer than the whole body; slender and enlarged at the apex and clad with purple-brown scales.

Thorax.—Prothoracic lobes brown covered externally by broad racquet-shaped bluish-white scales. Mesonotum brown with two central purple-brown stripes. When dry the mesonotum is a metallic-bronze. Just in front of the wings there is a bluish-white line composed of a single row of broad almost circular scales and the rest of the mesonotum is clad with dark brown and paler brown narrow-curved scales intermixed. There are the usual bristles which are dark brown and those overhanging the wings are unusually stout and long. Scutellum dusky-brown somewhat denuded but apparently entirely covered with very dark brown spatulate scales. Pleura

lark brown, crossed about the centre by a line of bluish-white broad scales. Wings; anterior edge of costa armed with dark brown spinose scales; here is a long area clad with dark brown scales on the anterior margin which embraces the basal three-fourths of the costa the whole of the subcosta and the basal four-fifths of the first long vein. These dark scales are all large scales with obliquely truncated ends arranged as a single row on the costa and subcosta and as a double row on the first vein. Each vein of the wing to the upper branch of the fifth lying below or posterior to the apical one-third of this dark band is clad with broad dark brown median scales thus giving the appearance of a dark band running transversely across the wing; the rest of the wing is scaled with bluish-white scales the blue being specially apparent in the living specimen. The median scales are all unusually broad and very large the lateral are large spindle-shaped scales and are present on the branches of the second, fourth and fifth veins and on the whole of the third vein. Coxæ of a paler brown than the pleuræ. Apparently without scales but with a few dark brown bristles. Femora clad above with purple-bronze scales and pale silvery-brown scales beneath. Mid femora enlarged. Legs clad with dark purple-bronze scales. Ungues equal and simple.

Abdomen.—Scaled above and below with dark purple-bronze scales. Male unknown.

Occurrence.—This small mosquito is invariably found in the neighbourhood of jungle pools or streams resting either on the surface of the water or on leaves or bits of stick.

Remarks.—It is extremely difficult to see and if disturbed as a rule rises and after a short flight settles again in the same place. I have never known them bite though I have taken a good number in a very small area.

Uranotænia Nivea. n. sp.

Thorax bronze-brown. In front of the wings there is a band of snowy-white scales which runs forwards getting broader as it goes until it meets its fellow of the other side. The head is covered with snowy-white scales. The anterior margin of the wing is clad with dark brown scales for the basal three-fourths and a more or less definite band passes across the wing about the junction of the middle and apical thirds. Abdomen with broad apical white bands. Last two joints and half the second joint of hind tarsus creamy.

Male Head.—Completely covered with silvery-white flat scales which on the vertex are long and spatulate but elsewhere are broad and racquet-shaped. I can detect no upright scales. The vertical and orbital bristles are dark brown and not very long. Basal joint of antenna dusky-brown without scales, remaining joints pale and translucent at apex and base, smoky between, covered with creamy hairs. Verticillate hairs dark brown. Clypeus brown. Palpi minute of a brownish colour clad with scales which take the colour of their background. Proboscis enlarged at the apex clad with dark brown scales which under a hand lens shew bronze-purple reflections.

Thorax.—Prothoracic lobes light muddy-yellow entirely covered with piriform silvery-white scales, and dark brown bristles except one which is silvery-white in the middle. Mesonotum brown: running round the anterior margin in front of the wings is a line of silvery-white scales, which near the wing are long and spindle-shaped but as they run forward become racquet-shaped and expand on to the dorsum of the mesonotum on each side forming a broad band, the pleura beneath this being covered with similar scales; the rest of the mesonotum is clad with rather long dark brown narrow-curved scales arranged in lines which form a marked contrast to the silvery-white scales at the sides. Under a hand lens these scales look black. Thoracic bristles long and stout. Scutellum similar in colour to the mesonotum clad with spatulate dark brown scales; bristles dark brown, those on the central lobe knocked off but from the scars I believe there were four bristles. Pleuræ are entirely covered with scales, a most unusual feature. Towards the front, behind and above the prothoracic lobe, the pleura is of a light muddy-yellow and is covered with silvery-white flat scales and a line of silvery-white scales crosses the centre of either pleura, the rest of the pleura being covered with dark brown flat scales. There are the usual bristles which are dark brown. Wings; basal three-fourths of costa with dark brown spinose scales on its anterior edge, a row of dark brown median scales, and on its posterior edge a row of lateral a-symmetrical dark brown scales except at the immediate base where these scales are silvery-white, subcostal with a row of dark brown a-symmetrical scales reaching nearly to its apex; first long vein clad with silvery scales for its first quarter dark brown scales on the second quarter, succeeded by silvery scales, and then dark brown nearly to the apex; second long vein with silvery scales at the base then dark brown scales to about its centre then silvery-white followed by dark brown scales to the base of the fork cell. Just before the base of the fork cell there are some broad a-symmetrical lateral scales on this vein in addition to the double median row along its whole length, there are other dark scales on the third long vein near its base and on the upper branch of the fifth, all the rest of the veins are clad with silvery-white scales very difficult to see except against a background. The median scales are for the most part broad with notched ends, the lateral only present on the fork cells and the third long vein are large spindle-shaped scales; the fork cells very small especially the first which is much the shorter of the two and is closely applied to the first long vein; posterior cross vein about twice its own length from median. Legs pale muddy-brown, clad with a few scales and a row of bristles; femora dark brown above, pale beneath; fore and mid tibiæ metatarsi and tarsi clad with dark brown scales, is some lights coppery, in others rose-purple; hind tibiæ and metatarsi similarly scaled, second joint of tarsus creamy at the apex third and fourth joints entirely creamy scaled; mid ungues unequal larger unguis simple and but slightly curved.

Abdomen.—Clad with dark brown almost black scales. On the dorsum of each segment at the apex is a patch of white scales much broader in the middle than at the sides, on the second segment nearly the whole dorsum is white scaled but the patch is not so large on the other segments.

Occurrence.—Described from one male taken in my own bungalow in the evening.

Remarks.—Easily recognized by the broad white marginal band on mesonotum and the densely scaled pleura. The wing also is very characteristic with its cordate median scales.

Uranotænia Campestris. n. sp.

Thorax brown with purple-brown scales and numerous bristles. A line of bluish-white scales in front of the wings, another shorter, crossing the centre of the pleura. Head with a narrow margin of pale blue scales to the eyes and dark purple-bronze scales over its surface. Proboscis swollen at the end, about as long as the abdomen. Legs clad with brown scales, unspotted and unbanded. Abdomen scaled with dark purple-brown scales. The fourth segment is clad with white scales above and at the sides on its apical half.

Female Head.—A tuft of narrow spindle-shaped bluish-white scales on the vertex, from this a line of small racquet-shaped bluish-white scales extends along the orbital margin on either side for about half-way when it turns backwards, the whole area between these narrow blue lines is clad with dark purple-brown scales, the purple tint is more evident under a hand lens than under a 2/3; behind are a few dark brown upright forked scales; vertical bristles long and dark brown, orbital bristles dark brown with pale tips. Basal joint of antenna dark brown, apparently without scales or hairs, second joint pale brown at the base, dusky at the apex, clad with several long dark brown bristles and at the apex with short silky-white hairs, remaining joints dusky-brown with numerous short white hairs; verticils dark brown. Clypeus dark brown. Palpi minute, closely applied to the clypeus, hairy. Proboscis about as long as the abdomen, enlarged at the apex, and clad with dark brown scales with purple reflections.

Thorax.—Prothoracic lobes dark brown, crossed obliquely by a line of bluish-white racquet-shaped scales, making one with the line on the pleura and head, and a line of dark brown bristles is inserted on the anterior face. Mesonotum brown, in some lights it is bronze-brown; on the margin in front of the wings is a narrow line of bluish-white spindle-shaped scales; the dorsum is clad with bronze narrow-curved scales; thoracic bristles dark brown, very large. Scutellum yellowish-brown, each lobe clad with spatulate scales with truncated ends; the spaces between the lobes are bare; central lobe with four dark brown bristles. Pleuræ light muddy-brown: about the middle there is a bluish-white line of spindle-shaped scales, below, between the fore and mid coxæ is a patch of similarly coloured racquet-shaped scales, and there are a few bristles which are dark brown. Wings with spinose scales on the anterior edge of costa dark brown in colour, and broad ones on the costa and subcosta, a double row of spindle-shaped dark brown median scales on the first long vein the other veins shew a single row of not very broad median scales, and the third vein and branches of the fork cells shew in addition large spindle-shaped lateral scales; fork cells very short especially the first which is much smaller than the second; median cross vein short, posterior twice its own length from median. Coxæ brown; fore and mid have each a patch of white flat scales; femora clad with purple-brown scales above, silvery, or silvery-brown beneath; mid femora enlarged. The rest of all the legs clad with dark brown scales which in some lights are coppery in others purple.

Abdomen.—Clad with dark purple-brown scales. Some of the segments have dorsal apical white bands the number and size of these bands varies but there is always a white band on the fifth segment which extends laterally to the venter.

Male.—Markedly plumose antennae. Mid ungues unequal the larger unguis simple but much curved. In other respects the male resembles the female.

Occurrence.—This mosquito is caught near its breeding places which are any swampy bits of open ground.

Remarks.—In many points this mosquito so closely resembles *V. Pygmæa*, Theobald, that I have some doubts about describing it as a new species. At the time of Mr. Theobald's description of Pygmæa there were very few Malayan Uranotænia known and hence points which are common to many species are emphasized as distinctive marks of *Pygmæa* and minor points were not brought out. The bluish-white line in front of the wings helps one but little as the majority of Malayan Uranotæniæ have this. The only points of difference between *Campestris* and *Pygmæa* seem to be the absence in *Campestris* of white scales on the stem of the fifth vein of the wing, the colour of the head scaling which in *Campestris* is distinctly bluish-white and dark olive-brown changing to dark blue in some lights and not black as in *Pygmæa*. There are other minor differences of colour which lead me to the conclusion that *Campestris* is a distinct species for in any other members of the genus which are undoubtedly distinct species the differences are often very small in the adults while well marked in the larval stage.

Uranotænia Argyrotarsis. n. sp.

Thorax dark umber-brown with bronzy narrow scales, a bluish-white line of erect lanceolate scales in front of the wing, another crossing the pleura; blue scales on the prothoracic lobes. Head with pale blue scales on the vertex and along the orbital margins, rich dark blue scales behind. Antennæ long; proboscis much longer than the abdomen. Legs brown, last three tarsi of the hind legs creamy, dorsum of abdominal segments two to four almost entirely scaled with bluish-white scales, remaining segments with blackish-brown scales.

Female Head.—On the vertex there is a patch of long lanceolate bluish-white scales, along the orbital margin on each side a line of bluish-white flat scales which is very broad leaving but a small area on the nape covered by dark blue scales and a few rows of almost black upright forked scales; two long dark brown vertical bristles and some dark brown orbital. Antennæ rather long, basal joint dusky, naked, second joint longer than succeeding joint, pale at the base, blackish-brown at the apex, remaining joints blackish-brown with silky-white hairs and dark brown verticils. Clypeus dark brown. Palpi very minute closely applied to the clypeus clad with dark brown scales. Proboscis long much longer than the abdomen enlarged apically clad with dark brown scales.

Thorax.—Prothoracic lobes brown, clad with rather large pale bluish-white racquet-shaped scales which run obliquely across forming a line with the line on the pleura. Mesonotum dark brown with two ill-defined paler lines on either side of the middle line clad with narrow-curved scales which

under a hand lens are a dark bronze under a 2/3 they appear very much the colour of their background only there is a metallic glint on them, in front of the wing on either side is a line of bluish-white erect lanceolate scales which are very long near the wing but get much smaller towards the front of the line. The mesonotal bristles are as usual very long they are dark brown in colour. Scutellum muddy-brown darker in the centre of the middle lobe, clad with racquet-shaped dark brown scales which in some lights are dark blue, bristles dark brown; four on the central lobe. Pleura dark brown crossed about the centre by a line of flat scales pearly-white in colour. Wing clad with dark brown scales the median small and spatulate the lateral large and either lanceolate or spindle-shaped, fork cells minute first narrower and shorter than second set close to first long vein, posterior cross vein about its own length from median. Coxæ brown with flat pearly scales and a row of dark hairs; femora scaled above with dark brown scales, below and laterally with silvery scales having a slight brownish tinge, mid femora enlarged, tibiæ with dark brown scales with purple reflections; metatarsi and tarsi of fore and mid legs with scales which get paler the nearer they get to the end of the foot so that the last tarsal joints are in some lights almost white, last three tarsal joints of the hind legs pure creamy-white. The ungues are equal and simple but the fore ungues though small have a swollen appearance at their base quite different from the mid and hind.

Abdomen.—Thickly clad with flat scales; on the first segment these are racquet-shaped and bluish-white, on the three following segments bluish-white scales cover the whole dorsum except just at the sides which are scaled with dark blackish-brown scales, remaining segments dorsally clad with blackish-brown scales. The venter has a pale basal band to all the segments. The markings on the abdomen are most characteristic.

Male.—In the male the antennæ are plumose the plumes being of a rather light purplish-brown with pale tips. The proboscis is much more markedly enlarged at the apex than in the female the enlargement seeming to be due to a thickening of the ventral surface. The mid tarsus is very characteristic, on the last two joints the scales are long and stand out giving a thickened shaggy appearance to the foot, the ungues are unequal the larger being much curved as is usual in members of this genus. The genitalia are too much retracted for their structure to be made out.

Occurrence.—Described from a series bred from larvæ taken in a pool in a patch of jungle off the Gombak Road five miles from Kuala Lumpur. I have taken one adult resting on the surface of the same pool.

Remarks.—I have not met with any other member of the genus with which this mosquito could be confused. The pure white hind tarsus and the abdominal marking are the most distinctive features.

Uranotænia Cancer. n. sp.

Bluish-white scales on the vertex and along the orbital margins, dark purple scales behind. Bronzy narrow-curved scales cover the mesonotum except for a line of bluish-white scales in front of the wings. A second line of similar scales is present on the pleura of each side. Abdomen with dark purple-brown scales above, large lateral white spots and apical white bands on the venter. Legs dark brown scaled with pallid coxæ.

Female Head.—Completely covered with racquet-shaped flat scales so characteristic of this genus; along the orbital margins the scales are bluish-white the white or the blue predominating as the direction of the specimen with respect to the light is altered, and laterally this line of scales broadens out into a distinct lateral patch. All the area surrounded by the blue scales is covered with purple-bronze scales. The depth of the line of blue scales seems to vary a good deal in different specimens. The type is as described but in other specimens nearly the whole of the upper surface of the head is covered with bluish-white scales the dark scales being confined to the nape. The dark scales are metallic and the colour varies a good deal according to the amount and direction of the light in some lights they appear a rich deep blue. There are no upright forked scales. Orbital and vertical bristles dark brown. Basal joint of antenna pale ochre-yellow, in some specimens more of an apricot colour, without scales, remaining joints dusky-brown with white tomentum and dark brown verticils. Clypeus pale yellowish-brown. Palpi very short closely applied to the clypeus which they resemble in colour clad with pale grey scales and numerous hairs. Proboscis about as long as the abdomen swollen at the end and scaled with dark purple-brown scales.

Thorax.—Prothoracic lobes dark brown with racquet-shaped flat scales covering the outer face which vary from a pearly-bluish-white to azure-blue as the direction of the light changes. Thorax patchy, in parts dark brown, in parts paler muddy-brown, clad with dark and lighter brown narrow curved scales and on either margin in front of the wing a line of lanceolate pale blue scales, bristles dark brown. Scutellum light brown thickly clad with purple-brown racquet-shaped scales, mid scutellar bristles about four in number but variable, probably because in some specimens one or more have been knocked off. Pleuræ pale with slight yellowish tinge with a distinct line of bluish-white flat scales crossing each pleura horizontally just above the insertion of the coxæ. Wings clad with dark brown scales which are not very typical in shape. The median scales are rather narrow spatulate scales with square ends, the laterals on the second long vein are clavate those on the third and fourth are lanceolate rather than spindle-shaped. Coxæ colourless clad with a few broad flat colourless scales, the rest of all the legs is covered with dark dull brown scales; ungues equal and simple.

Abdomen.—Light muddy-brown, dorsally clad with dark brown scales, laterally there are basal white spots and ventrally all the segments except the fourth are clad with white scales. The fourth is clad with brown scales at its base.

Male.—The male differs in the following points from the female: the antennæ are plumose, the enlargement on the proboscis is more marked and occupies fully one-third the total length instead of about a fourth as in the female, and on each fore leg the metatarsus is very short the joint being only about half the length of the succeeding joint and about one-third the length of the tibia. This itself is a very unusual arrangement. Immediately beyond the base of this metatarsal joint it is enlarged on its anterior surface gradually forwards for about half its length when the enlargement stops abruptly leaving a projecting edge exactly as if a notch had been cut in the joint. Some long dark brown narrow linear scales stand out on this

enlarged portion and at its apex a tuft of yellowish-brown scales with a sickle-shaped curved at their ends ; the remainder of the joint is very thin except just at the apex where it again swells out and where there is a long spinose dark brown scale inserted. Three of these scales are inserted above the length of the anterior surface of the first tarsal joint. The ungues are small and simple. In the mid leg the metatarsal joint is longer than any of the tarsal joints but the penultimate joint is unusually short shorter than the ultimate and the ungues are unequal the larger being much curved. The hind leg shews a small tuft of long scales at the apex of the tibia. The genitalia are too much retracted to make out.

Occurrence.—Abundant in crab holes at Port Swettenham and among plantations of Nepah palms between Port Swettenham and Klang and at Klang. The larvæ are found either in the water collected in crab holes or in stagnant pools or swamps.

Remarks.—The male of this mosquito is easily distinguished from all the other Uranotæniæ hitherto discribed by the presence of a curious tuft of long scales on the tibio-metatarsal joint of the fore leg. The female closely resembles some of the other members of the genus.

Uranotænia Longirostris. n. sp.

Thorax deep brown with brown scales and bristles, and a line of bluish-white erect scales in front of the wings, another crossing the middle of the pleura. Head almost entirely clad with bluish-white scales except over the nape where the scales are bronze-purple. Proboscis longer than the whole body. Legs and abdomen covered with purple-brown scales. A broad white ventral band about the middle of the abdomen.

Male Head.—Of a smoky-brown; on the occiput there is a small patch of scales which in some lights are dark bronze, in others, rich purple, elsewhere the scales are bluish-white, those on the vertex being rather long spatulate scales, the rest racquet-shaped. I cannot detect any upright forked scales. Orbital and vertical bristles dark brown. Basal joint of antenna dark brown, almost black, apparently without scales or hairs, remaining joints brown; verticillate hairs dark brown. Clypeus dark brown. Palpi minute closely applied to the clypeus brown scaled. Proboscis longer than the combined thorax and abdomen, clad with dark brown scales.

Thorax.—Prothoracic lobes dark brown clad with bluish-white flat scales. Mesonotum dark brown, almost black, clad with narrow-curved scales of a brown colour but not so dark as the mesonotum, and in front of the wings is a bluish-white line composed of scales which are erect and near the wing, spindle-shaped, but at the anterior end they are shorter and racquet-shaped. The mesonotal bristles are long stout and dark brown in colour. Scutellum blackish-brown, entirely clad with blackish-brown spatulate scales; bristles dark brown; central, four in number. Pleuræ dark umber-brown, crossed about the centre by a line of bluish-white racquet-shaped scales. Wings without spots, clad with dark brown scales of the usual type, spinose on the anterior edge of costa, large spindle-shaped lateral scales on the fork cells and third long vein, elliptical median scales on all veins; fork cells short, first much narrower but little shorter than the second, it base nearer the wing apex; cross veins meet an angle, posterior a little more than its own length from

median. Coxæ dirty-white; fore coxæ with colourless scales and some brown bristles, mid with a few scales; under sides of femora silvery, upper, dark brown; mid femora enlarged. The tibiæ, metatarsi, and tarsi clad with dark brown scales which vary in colour in different lights sometimes appearing bronze sometimes a light coppery colour. In some lights the scales on the tarsi of the fore legs look light silvery-grey. Mid ungues unequal, the larger unguis unusually large, even for a member of this genus.

Abdomen.—Above and laterally clad with dark brown almost black scales with bronzy reflections; on the venter the fourth segment is clad with light grey scales the rest of the segment being dark.

Occurrence.—Described from one specimen bred from a pupa taken in a pond.

Remarks.—The ventral white patch on the abdomen is much less distinct when the specimen is dry and old. The long proboscis and general dark colour of this mosquito render it fairly easy to detect, the single ventral white patch on the abdomen is very characteristic.

Uranotænia Modesta. n. sp.

A very small dull-coloured mosquito with a light brown thorax with darker patches clad with lines of black bristles and pale grey narrow-curved scales specially numerous on the lateral margins shewing under a hand lens as a greyish-white line on either margin. The legs and abdomen are clad with dark brown scales without banding or spots.

Female Head.—Muddy-brown shadowed with black, closely covered with broad racquet-shaped scales which vary in colour, under a hand lens they are dark bronze-brown but under other powers may shew a blue colour; the scales bordering the eyes are colourless and form a narrow pale line and behind on the nape are a few brown upright scales with broad serrated ends difficult to see, while on the vertex are a few golden bristles. Basal joint of antenna muddy-brown, nude. On the face, between the bases of the antennæ, and above the clypeus, are a few small white spatulate scales. The remaining joints of the antenna are dark brown to black clad with numerous long white hairs, and long verticillate hairs, dark brown, or almost black. Clypeus pale muddy-brown, nude. Palpi minute, covered with bronzy-brown scales. Proboscis thick, enlarged apically clad with scales similar to those on the palpi.

Thorax.—Prothoracic lobes large and rounded, muddy-brown in colour, without scales, but with three large dark bristles two on the upper surface one on the anterior. Mesonotum brown, with a black ring in the centre, and black patches laterally. With a hand lens it looks brown in the centre and entirely black laterally. There are scattered pale grey narrow-curved scales over the whole of its surface which on the lateral margins form two definite greyish-white lines; there is a line of dark brown bristles on either side over the wing base besides scattered bristles in front and behind on the dorsum. Scutellum muddy-brown, entirely clad with bronzy-brown flat scales; bristles long and dark brown. Pleuræ muddy-brown with patches of black without scales, and a few bristles inserted on the sterno-pleuræ. Wings with dark bronzy-brown scales, second long vein scarcely separated from first

its stem without median scales and with a very few curved spindle-shaped scales on its posterior edge, its upper branch is similarly scaled but on the lower there are narrow median scales and lateral scales on both edges, third vein has small spatulate median scales and large flat spindle-shaped scales on its anterior edge and small lanceolate scales on its lower edge; stem of fourth vein with small spatulate median scales no anterior lateral scales those on the posterior edge being very small transparent lanceolate scales extremely difficult to see; the branches have similar median scales but large narrow spindle-shaped lateral scales; stem of fifth only median scales, its upper branch has lateral scales on either margin its lower branch lateral scales only on the posterior margin; sixth vein only median scales except at the extreme tip. Coxæ pale translucent white clad with bristles only. Fore and mid femora slightly enlarged. Legs entirely clad with purple-brown scales which appear blue in certain lights and sometimes purple-brown, or pale bronzy-brown. Ungues minute equal and simple on all the legs. Metanotum light brown with a dark stripe in the centre.

Abdomen.—Entirely covered with purple-brown scales which vary to light bronze-brown or even blue according to the amount and angle of light, without bands or spots; venter pale with pale scales.

Male.—The male is in all respects similar except for the more plumose antennæ and its smaller size.

Occurrence.—Larvæ taken in water collected in the hollow of a tree at Ampang jungle.

Remarks.—Readily distinguished by the grey thoracic scaling and the broad bands of grey scales on the margins of the mesonotum.

Uranotænia Nivipleura. n. sp.

Pleura and coxæ silvery-white abruptly marked off from the dark brown mesonotum by a marginal line of silvery lanceolate scales. Mesonotum dark brown with black lanceolate scales and bristles. Head with dark blackish-brown scales in the centre and paler olive-brown ones at the sides. Proboscis, abdomen and legs with blackish-brown scales without banding or spots.

Female Head.—Entirely covered with large scales almost as broad as long and with very rounded ends which in the centre are dark olive-brown or almost black in a poor light but at the sides are paler, the two colours passing into one another without any abrupt line of demarcation; large upright scales extend forwards from the nape to the vertex and are of a dark brown colour with a few scattered ochraceous scales irregularly distributed; vertical bristles golden-brown, orbital black. Basal joint of antenna blackish-brown without scales, remaining joints dusky with black verticillate hairs. Clypeus muddy-brown. Palpi clad with dusky scales. Proboscis as long as the abdomen scarely swollen at the apex and clad with blackish-brown scales.

Thorax.—Prothoracic lobes silvery with black bristles but no scales. Mesonotum dark brown with long black lanceolate scales arranged more or less in rows and numerous long black bristles, and the lateral margins of either side a row of lanceolate silvery scales. Scutellum

dark brown with a patch of black spatulate scales on each lobe and four black bristles to the central lobe. Pleura creamy with a bright silvery sheen almost bare except for a few flat silvery scales. Coxæ bright silvery. Legs entirely clad with dark blackish-brown scales. Wings with dark scaled costa and silvery fringes, fork cells and scales of the usual type.

Abdomen.—Covered with blackish-brown scales without bands or spots.

Male.—Somewhat lighter in colour but in every other respect closely resembling the female. The head scaling is identical the vertical bristles are as in the female golden-brown. Antennæ markedly plumose the plumes being silky-brown and the joints pale muddy-brown. Pleura legs and abdomen as in the female.

Occurrence.—Described from one male taken by myself at "The Gap" and one female sent me by Dr. Finlayson of Singapore which he bred from a larva found in a pitcher plant.

Remarks.—A very distinct species the silvery pleura and dark mesonotum give it a very characteristic appearance. Evidently somewhat resembles U. Annulata Vol. III. "Monograph of Culicidæ," Theobald. It differs in the dark scaled head and unbanded abdomen and hind legs. Easily told from all the other Malayan species I am acquainted with.

Uranotænia Unilineata. n. sp.

Thorax reddish-brown. A silvery-blue line crosses the pleura on either side extends on to the prothoracic lobes and is in line with a bluish-white band on either side of the middle line on the head. Wings brown scaled. Abdomen and legs dark brown. The last two and apex of second tarsal joints on the hind legs creamy.

Female Head.—Dark brown in the centre paler at the sides and beneath ; on the vertex projecting forwards is a patch of bluish-white spindle-shaped scales, behind these there are scales of the same colour but racquet-shaped which diverge as two broad bands one along either orbital margin and then pass backwards and form one line with the scales on prothoracic lobes and pleura. These lines form a V on the head with the apex between the eyes, and the area between these lines and outside them clad with dark brown scales; behind on the occiput are a few dark brown upright forked scales. There are no vertical bristles and apparently only two orbital. Basal joint of antenna yellowish-brown and nude, second joint brown and hairy but without scales, remaining joints brown; verticillate hairs dark brown. Clypeus brown, without scales, heart-shaped. Palpi apparently two-jointed but little longer than the clypeus to which they are closely applied being bent inwards to the middle line, clad with dark brown scales and numerous bristles. Proboscis enlarged at the apex and clad with dark brown scales.

Thorax.—Prothoracic lobes brown, with a line of bluish-white flat scales crossing each lobe obliquely from behind upwards and forwards and making one line with the bands on the head and pleura. Mesonotum bright reddish-brown sparely clad with dark brown narrow scales scarcely curved which are arranged in a line in the centre with a bare space in either side

bordered by a line of long dark brown bristles outside which the scales are more thickly massed especially to the front; there are no flat scales on the mesonotum the conspicuous line of violet-blue flat scales on the side being inserted on the pleura. Scutellum yellowish-brown; on each lobe there is a patch of brown racquet-shaped scales. Pleura yellowish-brown with darker brown shadings, crossing the centre horizontally is a broad pale violet line composed of four rows of flat scales, and there are one or two rows of dark brown bristles. Wings fringed with brown, and clad with brown scales; costa dark, with brown spinose scales on its anterior edge and a single row of dark brown broad clavate scales on the posterior edge; first long vein clad with a double row of dark brown median scales some of which have obliquely truncated ends; towards the apex there are also a few pale long scales; stem of second long vein with pale brown piriform median scales with notched ends and at the apex in addition there are a few broadly clavate scales on its posterior edge; its upper branch has pale brown median and broadly clavate lateral scales its lower branch dark brown median and lateral scales which are of an irregular spindle shape; stem of fourth vein pale median scales, upper branch dark median scales pale spindle-shaped laterals, lower branch with dark brown median and one or sometimes two lateral scales; fifth and sixth veins with dark brown median scales and no laterals. Coxæ pale muddy-brown; fore and mid coxæ with patches of bluish-white scales on the outer faces; femora dark brown scaled above and laterally, paler scaled beneath; mid femora enlarged; tibiæ clad with dark brown scales; metatarsi and tarsi of fore and mid legs clad with dark brown scales which become paler and more metallic-coppery on the apical joints, in the hind legs the apex of the second tarsal joint and the whole of the last two joints are clad with creamy scales.

Abdomen.—Muddy-yellow, clad dorsally with dark brown scales and numerous ochraceous hairs the scales on the venter are pale yellowish.

Male.—Resembles the female except for the plumose antennæ and the mid ungues which are unequal one of them being very large.

Occurrence.—I have so far only taken this mosquito in the jungle close to water. I have never seen it feeding but have caught females which are full of blood. It is to be found settled on leaves or bits of stick in the neighbourhood of jungle streams.

Uranotænia Maxima. n. sp.

Head clad with small spatutate scales pale grey along the orbital margins, bluish-grey at the sides, and dark olive-brown in the centre. Prothoracic lobes with grey scales. Mesonotum light brown with dark brown scales and a bare line on either side of the middle line, and numerous long dark brown bristles; round the margin in front of the wing is an edging of pale grey scales clavate near the wing, lanceolate near the anterior end of mesonotum. Pleuræ light brown crossed by a line of grey scales. Abdomen dark brown unspotted and unbanded. Legs dark brown.

Female Head.—There is a narrow line of pale grey scales along the orbital margins, a patch of pale blue-grey scales on either side, and the rest of the head is covered with brown scales which under a hand lens look almost black under 2/3 olive-brown or blue-black, and numerous upright

forked scales, some inserted as far forward as the orbital margins near the vertex ; orbital bristles brown, vertical dark brown. Basal joint of antenna ochre-yellow with dark shading on the inner side and some small spindle-shaped scales, remaining joints dark brown with dark brown verticils. Clypeus dark brown, heart-shaped. Palpi small, about one-ninth the length of the proboscis which is rather longer than the abdomen ; both palpi and proboscis with dark brown scaling.

Thorax.—Prothoracic lobes brown with dull white flat scales. Mesonotum light brown ; the whole of the margin in front of the wing is edged with dull white or grey scales, which near the wings are flat, elongated, clavate scales but become lanceolate as they approach the anterior end of the mesonotum, and in the centre is a line of narrow curved scales and on either side of this a bare line, the rest of the mesonotum being clad with narrow-curved scales, which under a hand lens are dark bronze-brown, but under higher powers in a good light they appear paler and more olive-brown ; the bristles on the mesonotum are dark brown and very long the dorso-central rows being well-marked. The scutellar scales are small flat scales with rounded ends and of an olive-brown colour ; central bristles four in number. Pleura light yellowish-brown with dark brown patches and crossed about its centre by a horizontal line of dull white spindle-shaped scales. Wings clad with brown scales, a single row of small spatulate median scales on all veins after the first, and lateral scales present on the second vein and its branches, the whole of the third, and the branches of the fourth the scales are broad with obliquely truncated ends, except on the third vein where they are more elliptical, the fork cells are of about equal length, the second being rather broader than the first, and having its base nearer the wing base ; posterior cross vein longer than median, from which it is distant by less than its own length. Coxæ pale yellowish-brown, femora pale beneath, dark brown above, remainder of all legs dark brown scaled. Ungues equal and simple on all the legs.

Abdomen.—Dark brown above, pale dirty-white beneath. Segments fringed with pale golden hairs. No banding or spotting.

Occurrence.—The specimens from which this description is drawn were taken in jungle at " The Gap " Selangor. They were not taken feeding though I expect they do bite.

Remarks.—I have a male mosquito which in many respects resembles this species but it lacks the grey line of flat scales round the margin of the mesonotum and I am not sure whether it is the male of this or not, and have refrained from so describing it until I obtain more material. This mosquito is the largest Uranotænia I have found and is easily distinguished by its size alone.

Uranotænia Lutescens. n. sp.

Thorax pale translucent yellowish-brown covered with a few black scales and bristles. Head, proboscis and legs with purple-bronze scales. Abdomen dark brown with narrow yellowish-brown basal bands.

Female Head.—Clad with flat racquet-shaped scales which vary considerably in colour according to the light, under a hand lens they appear light bronze with a paler grey margin to the eyes, under a 2/3 some of the

scales are fawn-brown or coppery-brown others dark grey, there are a few upright forked fawn-coloured scales on the nape; vertical bristles grey orbital dark brown with grey tips. Basal joint of antenna chestnut-brown with a few hairs on its inner face, remaining joints dark brown with numerous white hairs, verticillate hairs dark brown. Clypeus chestnut-brown, nude. Palpi about twice as long as the clypeus; joints indistinguishable clad with brown scales and numerous hairs. Proboscis enlarged at the extreme apex, covered with dark purple-bronze scales.

Thorax.—Prothoracic lobes light yellowish-brown with a row of dark brown bristles on the anterior face, but no scales. Mesonotum light yellowish-brown, semi-translucent, covered thinly with narrow-curved scales which are brown in shade but clay-coloured in the light; the median thoracic bristles are long and dark brown in colour with pale tips. Scutellum of the same colour as the mesonotum clad with spatulate fawn-brown scales, and dark brown bristles of which there are four on the central lobe. Pleuræ similar to mesonotum but rather paler, with a few bristles arranged in rows, of a dark brown colour. Wings quite typical, with fusiform light brown scales. Coxæ of the same colour as the pleura with bristles only; legs covered with dark brown scales shewing purple and coppery reflections, under sides of femora pale; mid thighs swollen.

Abdomen.—Dorsally clad with dark brown scales with coppery and purple reflections; the first segment has a patch of dark brown scales in the centre and golden-brown scales laterally, the remaining segments have basal bands of light yellowish-brown scales; venter pale.

Male.—Antennæ plumose, verticillate hairs iridescent. Pleuræ and coxæ are translucent white. The abdominal banding flaxen the bands being much broader than in the female and extending laterally, indeed one might almost say the abdomen is clad with flaxen scales with dark brown apical patches on the dorsum of each segment though the amount of banding differs in different specimens. Mid ungues unequal and simple.

Occurrence.—This mosquito is as far a I know exclusively a bamboo breeder and sylvan. I have never taken the adult though the larvæ are not uncommon in bamboos. I have so far not succeeded in inducing it to feed (except on fruit) or to breed.

Remarks.—The only feature in which this mosquito deviates from the type of the genus is the absence of flat scales on the mesonotum but I do not think this ought to exclude it from the genus. In larva, pupa and all adult characters it is typical. The pale ochraceous mesonotum and pleura and the regularly banded abdomen are distinguishing points.

Uranotæna Maculipleura. n. sp.

Thorax under a hand lens is plum-coloured clad with bronzy narrow curved scales and long bristles. The pleura is creamy with three dark brown spots. Head covered with racquet-shaped scales brown in colour in some lights, blue-black in others. Proboscis, legs, abdomen and wings clad with dark brown scales with purple reflections.

Female Head.—Entirely clad with flat racquet-shaped scales of a blue-black colour, which colour varies somewhat but as a rule is olive-brown

with a purple tinge (madder brown is I believe the technical term for such a colour). Under a hand lens the scales over the central area are dark brown and low down at the sides the scales appear bluish ; there are brown upright forked scales with very broad serrated tops extending as far forwards as the vertex ; the vertical bristles are golden-brown the orbital dark brown. Basal joint of antenna is yellowish-brown with a few dark brown hairs on its inner and upper face, second joint dusky-brown with a few flat dark brown scales at the base and numerous short hairs densest towards the apex, the verticillate hairs are represented by three or four long dark brown hairs inserted at different levels near the base, remaining joints dusky-brown, with dark brown verticillate hairs. The antennæ are very long. Clypeus dark brown and nude. Palpi small but not so minute as they are as a rule in members of this genus, apparently two-jointed, the terminal joint thick, and projecting well beyond the clypeus, very hairy and clad with dark brown scales. Proboscis thick, about as long as the abdomen, clad with dark purple-brown scales.

Thorax.—Prothoracic lobes dark brown clad with flat scales which take the colour of their background and a row of long dark brown bristles. Mesonotum under a hand lens appears of a rich plum colour but under a 2/3 it appears of a dark brown shadowed with purple in places ; it is clad with narrow lanceolate scales slightly curved and of a pale fawn-brown colour ; the bristles are large and dark brown. Scutellum dark brown, clad with small broad racquet-shaped dark brown scales, and with dark brown bristles which judging from the scars must have been five in number on the central lobe. Pleuræ, of a creamy colour with a yellowish tinge above, marked by four large dark brown spots one just behind the prothoracic lobe a small one immediately behind this, another large one above the middle coxa, and behind this a large fourth spot. The brown patch above the middle coxa is covered with broad flat scales of a silvery-grey colour and running down its posterior edge is a line of dark brown bristles which is continued right down to the coxal insertion. There are other bristles on the brown patch behind and just beneath the prothoracic lobe in front is a small brown spot on which is a tuft of bristles. Wings clad with sepia brown scales of typical shape, the scales on anterior edge of costa spinose, the median scales on veins one to four small and spatulate, on the sixth and stem of fifth veins larger, and with rounded ends ; lateral scales present on branches of the forked veins and the whole of the third lanceolate at the base of the veins but more spindle-shaped towards the apices; fork cells small, first much smaller than second, its base nearer wing apex ; posterior cross vein about its own length from median. Coxæ ochraceous ; fore coxæ brown in front and covered with numerous hairs ; fore legs broken off ; mid femora with ochraceous scales at the base and on most of the ventral surface, dark purple-brown scales above and laterally, remainder of the leg dark brown scaled. In some lights the scales have a metallic-bronze or almost coppery tint. Hind legs similar.

Abdomen.—Entirely clad with scales showing sometimes dark brown sometimes purple-bronze.

Occurrence.—Only one specimen taken beside a jungle stream about six miles from Kuala Lumpur.

Remarks.—This mosquito is like *U. Bicolor* rather large and the head l thoracic scaling is somewhat similar, but it can be at once distin- shed from *U. Bicolor* by the absence of abdominal bands and the sence of the large pigment spots on the pleura.

Uranotænia Bicolor. n. sp.

Thorax pale yellowish-brown with dark purple-brown patches clad h rows of light fawn-brown scales. Head clad with flat dark brown ales with bronze reflections and dark brown upright forked scales ending forwards to the apex. Wings with brown spindle-shaped scales. oboscis palpi and legs with dark umber-brown scales. Abdomen with k brown scales with basal bands of fawn-coloured scales much broader the male than female.

Female Head.—Entirely clad with flat almost spindle-shaped dark vn-brown scales except along the orbital margins where the scales are nost white and with brown upright forked scales inserted on the nape d right forwards to the vertex; vertical bristles golden-brown, orbital rk brown. Basal joint of antenna yellowish-brown rather darker on the ner half with numerous downy hairs and (?) a few small scales, second nt no longer than succeeding joint with a few dark brown spatulate ales at the base and numerous rather long silky-white hairs, remaining nts dusky-brown paler at the insertion of the verticils which are dark own. Clypeus brown (?) nude. Palpi very short with two apparent nts clad with brownish scales which in some lights have a silvery lustre. oboscis about as long as the abdomen clad with dark brown scales some ler ones at the apex which is enlarged, labellæ pale yellowish-brown.

Thorax.—Prothoracic lobes dark blackish-brown clad with pale almost nite racquet-shaped scales and some long dark brown bristles. Mesonotum wny-yellow with dark coloured patches one in front of the scutellum and o on either side in front of the wings, clad rather sparely with tawny rrow-curved scales with some dark brown ones at the side in front and merous long dark brown bristles. In some specimens under a hand ns the anterior margin shews a line of light tawny scales running round while the rest of the mesonotum is clad with purple-bronze scales with rrow lines of pale golden scales in the centre. Scutellum yellowish- own with a dark purple-brown spot in the centre clad with flat spatulate ales which are fawn-brown or blue-grey according to the light; bristles rk purple-brown, four on the central lobe. Pleuræ pale yellowish-brown ith dark purple-brown patches, and a line of white spatulate scales cross- g the centre horizontally and another line running vertically downwards om the horizontal line between the fore and mid coxæ. Wings clad with rk brown scales where massed with a distinct purple tinge; costa with inose scales on the anterior edge, subcosta clad with rather long spatulate ales; first long vein with a double row of small median scales with uncated ends and towards its apex with a few spindle-shaped lateral ales on the anterior edge; second vein running close to first some small rrow scales with square ends on its stem, a few large blunt-ended spindle- aped lateral scales at the apex of the stem and spindle-shaped lateral ales on the branches; remaining veins with a single row of median

scales and large lateral scales on the whole of the third branches o the fourth and apex of upper branch of fifth. At the base of third vei the scales are lanceolate getting broader as they approach the apex of th vein those at the very apex being as broad as long and very blunt ended The sixth vein is very sharply curved towards the end ; fork cells short, firs shorter but scarcely narrower than second closely applied to first long vein posterior cross vein very long, longer than median from which it is distan less than its own length. Coxæ pale yellowish ; fore coxæ with flat whit scales. Femora scaled dark brown except beneath towards the base and very narrow ring of pale scales at their apices ; tibiæ metatarsi and tars clad with scales which are dark brown or dark purple-brown or coppery bronze according as the direction of the light varies. Ungues equal an simple.

Abdomen.—Clad with dark brown scales with purple reflections an basal bands of dirty white or in some lights of a tawny colour.

Male.—The male has short palpi and differs in the following point from the female. Antennæ plumose with two last joints elongated ; plume a light silky-brown with a purple tinge in some lights. Wing rather mor lightly clad on the costa. The ungues of the mid leg are uneven the large unguis being much curved. This is a most characteristic feature of thi genus so far I have not seen any Malayan mosquito outside the members o this genus in which this is present. The abdominal bands are much broade than in the female and tend to be broader laterally than in the middle. Th band on the two last segments is narrow.

Occurrence.—All the specimens I have were bred from larvæ taken fron the marshy edges of a jungle stream in Kuala Lumpur. I have neve taken the adult fly.

Remarks.—This is certainly the largest of the Malayan member o Uranotænia next to Maxima. The absence of flat scales on the mesonotun and the regular banding of the abdomen serve to distinguish it from all th other species.

Uranotænia Bi-maculata. n.sp.

Head entirely covered large broad flat bluish-grey scales with a fev upright scales behind, mesonotum brown in front, purple-brown behind clad with narrow-curved tawny and grey scales. On either side, just abov the insertion of the wing, is a large spot covered with black narrow-curved scales and edged with pale grey. Pleuræ pale ochraceous. Legs and abdomen dark brown.

Female Head.—Under a hand lens the scales along the orbital margin and at the sides of the head are pale grey surrounding dark slate-grey scales but under a 2/3 this contrast is not noticeable the scales over the whole head appearing light blue-grey. The upright scales behind are very few confined to the nape, and apparently ochraceous though they may take this tinge from the front of the thorax or neck, vertical and orbital bristles dark brown. Basal joint of antenna dark brown and naked, remaining joints brown with dark brown verticillate hairs. Clypeus yellowish-brown very pointed. Palpi very short but longer than in many members of this genus, clad with dark brown scales. Proboscis about as long as the abdomen swollen at the end and clad with dark brown scales.

Thorax.—Prothoracic lobes brown, clad with silvery-grey spindle-aped scales. Mesonotum under a hand lens is dark chestnut-brown with onzy narrow-curved scales but under a 2/3 these scales appear more ive-brown or tawny; on either side of the mesonotum in front of the ng, is a large oval spot of velvety-black scales with a light silvery-grey ging. This spot is so marked a feature of this mosquito that there is no her species it could be mistaken for. There are numerous long dark own bristles inserted on the dorsum in front of the scutellum and over e bases of the wings. Scutellum dark brown with three patches of small t scales grey in colour though this is somewhat obscured by the brown the scutellum; bristles dark brown number of central four. Pleuræ ochra-ous with three chestnut-brown spots above and silvery scales. Wings of e usual type though the first fork cell is not so short as usual; scales own with purple tints, lateral scales, fusiform; posterior cross vein about s own length from the median. Coxæ pale ochraceous; femora creamy eneath clad above and laterally with dark brown scales which appear onze or purple according to the angle of the light; rest of all legs with own scales with purple-bronze reflections; ungues equal and simple on l the legs. The male resembles the female in all respect except for the umose antennæ the plumes being silky olive-brown. The genitalia are o retracted to make out their structure.

Occurrence.—The mosquito is fairly common in damp places in the ngle at "The Gap" though so far it is the only place I have taken it.

Remarks.—The large eye-like spots on the mesonotum at once distin-uished it from all the other Malayan species of this genus. Like all the ranotænia it probably bites at times but so far I have been unable to ove this. It is always found in the neighbourhood of streams or settled n rocky boulders over which water drips. I have not taken the larvæ.

Uranotaenia Fusca. n. sp.

Head entirely clothed with small racquet-shaped scales and numerous right scales with dentate ends; the scales along the orbital margin of ther side are pale brown, and a line of similar scales runs down either side the centre and as it approaches the occiput curves outwards. Thorax ad with narrow scales those on the anterior margin tawny, and, on the rsum are three lines of tawny scales one central on the anterior half and ne on either side on the posterior half, the rest of the scales being black. bdomen unbanded in the female, banded in the male. Legs with dark rple-brown scales.

Female Head.—Along the orbital margin of either side is a line of pale own scales and a similar line runs down on either side of the centre from ertex to occiput curving outwards as it passes backwards. This is much etter seen in the male. The rest of the head is covered with dark bronze-own racquet-shaped scales and numerous dark brown upright scales. lypeus deep brown. Palpi and proboscis clad with deep brown scales. asal joint of antenna deep brown, remaining joints black with black rticillate hairs.

Thorax.—Prothoracic lobes black with a few dull-coloured racquet-aped scales. Mesonotum pale muddy-brown: running round the anterior

margin is a broad line of tawny narrow scales; a band of similar scales runs down the centre of the anterior half and on the posterior half a line of tawny scales runs forwards from either lateral lobe of the scutellum and ends opposite the point where the anterior central line terminates; the rest of the mesonotum is clad with black narrow scales and numerous long dark brown bristles. Scutellum ochraceous, each lobe clad with a patch of small spatulate scales; scutellar bristles black. Pleuræ ochraceous with dark brown patches. Wings clad with the typical fusiform lateral and spatulate median scales. Coxæ pale ochraceous. Legs clad with deep purple-brown scales with bronzy reflections.

Abdomen.—Covered with deep purple-brown scales.

Male.—Central lines on the head much more distinct than in the female. Basal joint of antenna prolonged into a conical point on its inner aspect; remaining joints dingy-white with a black ring in the centre of each where the verticillate hairs are inserted; verticillate hairs long and dark brown with a purple tinge. Mid ungues markedly unequal the larger unguis much curved but simple. Abdomen with broad basal bands of a tawny colour.

Occurrence.—Described from a series bred from larvæ from a small pool at Sungei Limbing taken by Dr. Daniels.

Remarks.—Although the male shews some points of difference from the female, notably the broad abdominal bands, there can be little doubt it is the male of this species. They were bred from the same batch of larvæ and the peculiar thoracic ornamentation is similar in male and female. It is a very dull-coloured and small mosquito but a typical Uranotænia and easily distinguished from all the other Malayan species by the thoracic ornamentation.

Genus 9.—**Ficalbia.**

"Head clothed entirely with racquet-shaped scales with a few short upright forked ones behind; palpi very short, two-jointed; proboscis rather long, enlarged apically. Thorax with narrow-curved scales, no flat ones as seen in Uranotænia; scutellum covered with racquet-shaped scales as in the latter genus. Wings with fork cells moderately short; the first sub-marginal longer than the second posterior; median wing scales broad and spatulate; upper border of costa with spine-like scales; ungues of male unequal and simple.

"This genus is sparated from Aedes and Verrallina, on account of the complete flat scaled structure of the head and scutellum and from Uranotænia on account of the more normal fork cells and complete absence of flat scales on the mesonotum."

Remarks.—I have only one species that I can place in this genus. It answers to most of the characters of the genus. The male genitalia are very remarkable.

Ficalbia Longirostris. n. sp.

Head clad with purple-bronze racquet-shaped scales. Thorax brown, with bronzy narrow-curved scales. Scutellum with flat spatulate dark brown scales. Legs and abdomen dark brown.

Female Head.—Clad with very dark brown racquet-shaped scales with ırple reflections set in imbricate rows, and at the sides with a few pale ɔlden-brown scales, and round the margin of the occipital foramen there is ıe row of black upright forked scales rather difficult to see; orbital and ertical bristles almost black. Basal joint of antenna dark brown without :ales, remaining joints dark umber-brown with numerous silky-white airs and dark brown verticils. Clypeus dark brown and nude. Palpi ery short, clad with dark brown scales similar to those on the proboscis. he proboscis is of great length as long as the body though in the dried ɔecimen owing to the shrinking of the body it may appear longer.

Thorax.—Prothoracic lobes dark brown with dark brown bristles only. Iesonotum dark brown with brown narrow-curved scales and dark brown ristles. Scutellum yellowish-brown with small spatulate scales on each ɔbe and bare spaces between; bristles dark brown, four to the central lobe. 'leuræ brown with a few dull white flat scales. Wings brown with brown :ales; median small narrow spatulate scales, lateral short linear scales; ɔrk cells about equal in length and breadth; stem of first about as long as ıe cell, base of first nearer wing apex than base of the second; posterior ross vein nearly twice its length from mid. Coxæ pallid clad with a few at dull-white scales. Legs entirely clad with dark brown scales with urple reflections except the under sides of the femora. Abdomen clad ;ith dark brown scales above; ungues equal and simple.

Male.—Antennæ plumose, joints banded white and brown last two ɔints as long as the whole of the antenna. Proboscis of great length lightly swollen at the tip. Fore and mid ungues simple but they are pparently unequal though it is difficult to make sure of this. The basal ɔortion of the external genitalia is of extraordinary length and being curved he pair look just like calipers at the end of the abdomen, the claspers are inged to the end and these basal pieces and other chitinous processes ɔroject from the inner and ventral faces but the parts are so distorted with lrying that it is impossible to give an accurate description of the structure.

Occurrence.—The series were bred from larvæ found in stagnant water .t Kuala Klang. Time of capture January.

Remarks.—This is a very distinct species the long proboscis and the :urious male genitalia at once distinguish it. The wing scales of this nosquito are certainly unlike those given as typical of members of this ;enus but without forming a new genus there is no other place for it.

Genus 10.—**Hodgesia.**—Theobald.

Head clothed with small flat scales rather rounded apically and loosely ıpplied to the surface; palpi very small, apparently one-jointed, covered ;ith scales; antenna with large globular basal joint, thirteen-jointed, long ɔristles at the nodes, short ones at the internodes; proboscis not quite as ong as the whole body; clypeus normal. Thorax with prothoracic lobes :overed with flat scales; mesonotum with large long narrow-curved scales; scutellum with small flat scales similar to the head; abdomen with flat scales arranged vertically so as to form slightly projecting tufts. Legs ong, especially the hind pair; apices of the femora and tibiæ rather dilated;

fore femora slightly swollen; ungues equal and simple in the female. Wings with the normal culicine venation but the third long vein is carried past the marginal cross vein as a scaled vein; the lateral vein scales long and nearly overlapping those of contiguous veins, their apices with marked lateral spines.

Remarks.—To the above characters should be added antennæ pilose in male and female.

Hodgesia Quasisanguinæ. n. sp.

A very small mosquito with shiny black mesonotum clad with black scales. Head with racquet-shaped scales only, black, except for large silvery spot on the vertex and a small silvery spot on either side. Abdomen with five lateral silvery spots.

Head.—With only racquet-shaped flat scales which are blackish-brown except on the vertex and over a small round area on either side where they are pearly-white there are no upright scales. Clypeus blackish-brown and nude. Palpi exceedingly short clad with dark black-brown scales. Proboscis about as long as the abdomen dark scaled. Antennæ with black naked basal joint; remaining joints dark brown with black verticils.

Thorax.—Prothoracic lobes blackish-brown clad with pearly-white ovoid scales. Mesonotum black, with a brownish tinge in a strong light, shining, clad with black narrow-curved scales. Scutellum black with small blackish-brown scales triangular in shape. Pleura bronzy with a patch of silvery scales. Wings much longer than abdomen clad with brown scales, the median small spatulate scales with square ends, a double row on branches of second vein and on whole of third vein, a single row on all veins after the third, lateral scales long and narrow with lateral spines at their free ends; first fork cell a little longer than second, its stem about as long as the cell, its base nearer the apex of the wing than the base of second; posterior cross vein about its own length from median. All legs clad with dark brown scales with purple reflections; the hind femora clad with silvery scales except at their extreme apex; ungues simple and equal.

Abdomen.—With dark blackish-brown scales with purple reflections. There are large lateral spots on segments one, two, three, five, and six that on the fifth segment being carried on to the dorsum and nearly meeting its fellow of the opposite side.

Occurrence.—Described from females taken in jungle in the neighbourhood of Kuala Lumpur.

Remarks.—These small mosquitoes are not very common. They are rather vicious biters but very shy in settling. In many respects they closely resemble members of the genus Uranotænia, the abdominal markings being exactly the same as in *Uranotænia Campestris*. The equal fork cells however and the peculiar lateral wing scales afford a ready means of distinguishing them. Since writing my description a paper has been published by Mr. Theobald in the "Journal of Tropical Medicine" describing a mosquito from Africa for which he created the genus Hodgesia and called the mosquito *Hodgesia Sanguinæ*. From the drawing of the wing scales and general description it is evident that the mosquito described here belongs to that genus. It so closely resembles H. Sanguinæ that

have called this species *H. Quasisanguinæ*. *H. Quasisanguinæ* differs from . *Sanguinæ* in the presence of small silvery lateral spots on the head, the stance of posterior cross vein of wing from the median, the level of the ises of the fork cells (the base of first fork cell in H. Quasisanguinæ is earer the apex of the wing whereas in H. Sanguinæ it is nearer the base the wing), and the arrangement of the lateral abdominal spots, for in . *Quasisanguinæ* the unspotted segments are four, seven and eight, while in . *Sanguinæ* they are three, seven and eight. There are no spots in . *Malayi*.

Hodgesia Malayi. n. sp.

Head with racquet-shaped scales black except on the vertex and along e orbital margins where they are pearly-white. Abdomen without teral spots.

Head.—Brown, clad entirely with racquet-shaped scales which on the ertex and along the orbital margins are pearly-white, behind on the ciput dark brown with purple reflections. Basal joint of antenna ferruinous, unscaled, remaining joints light brown with dark verticils. lypeus ferruginous. Palpi very short clad with dark brown scales. Proboscis dark brown.

Thorax.—Prothoracic lobes thickly covered with pearly-white elliptical cales. Mesonotum ferruginous clad with bronze-brown narrow-curved cales and dark brown bristles. Scutellum with brown racquet-shaped cales. Pleura ferruginous with one or two patches of pearly-white scales. Vings clad with scales of the generic type ; fork cells long, first longer than econd, its base nearer the apex of the wing, its stem almost as long as ne cell ; posterior cross vein less than its own length from the median. egs clad with dark brown scales ; Hind femora silvery ; ungues equal and mple.

Abdomen.—Entirely clad with dark brown scales without bands or pots.

Male.—Much smaller than the female. Antennæ pilose. Except for s size it can scarcely be told from the female as the genitalia are ractically hidden.

Occurrence.—Described from a series bred from larvæ taken in pools n jungle near Kuala Lumpur.

Remarks.—A true Hodgesia and easily distinguished from *H. Quasisanuinæ* by the longer fork cells broad silvery orbital margins and the absence f abdominal spots.

Genus 11.—**Zeugnomyia**.—nov. gen.

Proboscis very long, as long as the whole body. Antennæ pilose in nale and female but the joints being shorter in the male the verticils are earer together and give the antennæ a rather more plumose character than n the female. Abdomen very slender. Head closely covered with spatulate cales with a few large racquet-shaped scales on the vertex, and upright cales small and few in number on the nape. Thorax clad with narrow nceolate scales and a patch of racquet-shaped silvery scales in front of

each wing. Scutellum with spatulate scales. Wings hyaline with onl median scales except for a few lateral scales on the first long vein an sometimes one or two scales on the first fork cell; fork cells remarkabl short less than one-sixth the total length of the wing. Palpi four-jointed i the female, three-jointed in the male about one-seventh the length of th proboscis in both.

Remarks.—Only one species of this genus at present known. Th characters are very distinctive and quite warrant the formation of a nev genus. It is closely allied on the one hand to Colonemyia and in som points to Skeiromyia, and on the other hand to Uranotænia. In fact i links on the Uranotænias to Colonemyia and Skeiromyia and through then to the Wyeomyia; hence its name.

Zeugnomyia Gracilis. n. sp.

Body slender. Proboscis as long as, or longer than, the abdomen Head clad with purple-black scales with a pearly-white margin to the eyes Prothoracic lobes pearly-white. Thorax brownish-black, glistening, and clad with narrow black scales; and a broad patch of pearly-white scales which begins in front of the wings and passes almost vertically downwards over the pleura. Fork cells very short. Wings hyaline.

Female Head.—Head black, entirely covered with broad scales with rounded ends those in front being racquet-shaped; on the vertex is a patch of glistening pearly-white scales, and along each orbital margin are similar scales; the rest of the scales are black with a slight brownish tinge in a good light; there are a few black upright forked scales behind. Basal joint of antenna black, with pearly-white scales except on the outer surface. remaining joints black, with black verticils. Clypeus black and nude. Palpi slender, about one-seventh the length of the proboscis four-jointed, two first joints short, of equal length; third joint about four times as long as the first, swollen and ovoid in shape, fourth joint slender, and as long as the others combined. Proboscis very long, longer than the abdomen, it and the palpi clad with black scales.

Thorax.—Prothoracic lobes black with pearly-white elliptical scales Mesonotum black clad with brownish-black narrow-curved scales. In front of the wings, and extending inwards from the margin is the beginning of a line of flat pearly-white scales which instead of running forward as is usual, runs vertically downwards forming one with a broad line on either pleura. Most of these scales are oval but a few are long with rounded ends. Mesonotal bristles black. Pleuræ dark purple running vertically down the centre is a broad line of pearly-white broad scales with rounded ends which begins in front of the wings on the mesonotum. Scutellum black, clad with spatulate black scales and bristles which are black in the living fly and blackish-brown in the dried specimen. Wings hyaline (this feature is specially noticeable in the fresh specimen) clad with dark brown scales; there are a few spinose scales on the anterior edge of the costa; all veins with a single row of narrow median scales and without lateral scales; fork cells very small, of equal length, the first being narrower than the second, the stem of the first cell is quite twice as long as the cell; posterior cross vein quite close to the median. Coxæ dark brown

with pearly-white scales; trochanters light yellowish-brown; legs with brownish-black scales with purple and bronzy reflections, the scales on the tarsi being rather pale and more coppery; under side of hind femora silvery; ungues simple and equal.

Abdomen.—Black scaled above, the last segment with a narrow band of pearly-white scales near the base; all segments with triangular basal lateral spots: two first segments pearly-white beneath.

Male.—Antennæ pilose with the two last joints elongated. Proboscis longer than in the female. Hind femora with rows of pale golden spines. Ungues on fore and mid legs unequal, the larger unguis uni-serrate Genitalia unfortunately concealed by retraction in drying.

Occurrence.—This mosquito is fairly common in certain localities and is a vicious biter. It is commoner during the months of October to December than at other times. I have taken odd specimens at all times of the year at Jugra and around Kuala Lumpur. The larva I have found in water collected in fallen leaves associated with other larvæ which it devours as it is larvivorous.

Remarks.—There is no other mosquito this could possibly be confused with. When seen flying there is a gauziness about it which reminds one more of the Wyeomyina. It is quite black and white when fresh though the black fades and becomes brownish after drying. All the scales have a shiny glistening appearance and the abdomen is narrow at its insertion giving the insect the appearance of having a waist.

Genus 12.—**Colonemyia.**—NOV. GEN.

Proboscis very long, as long as the whole body. Abdomen slender Antennæ pilose in male and female but as in Zeugnomyia the verticils in the male are nearer together by reasons of the antennal joints being shorter and hence the male antennæ appear slightly plumose. Head covered with spatulate scales generally rich metallic-blue on the anterior half. Palpi slender and of moderate length about one-ninth the length of the proboscis. Prothoracic lobes with flat metallic scales. Mesonotum with long hair-like scales. Scutellum with spatulate scales sometimes metallic. Wings with fork cells moderately long; lateral scales linear or clavate.

Remarks.—In the length of the proboscis and the slender abdomen the members of this genus resemble Zeugnomyia while the larva closely resembles that of Skeiromyia the larvæ of both are very hairy and each has a curious hooked chitinous process inserted on the thorax at the posterior angle. Three species of this genus are at present known and all agree in being more particularly bamboo breeders and commoner at high elevations.

COLONEMYIA CÆRULEOCEPHALA. N. SP.

Thorax light yellowish-brown (to the naked eye it looks orange-coloured) testaceous, and clad with black narrow-curved scales. A rich dark blue band runs transversely across the head with darker blue-black scales on the nape. Proboscis longer than thorax and abdomen together. Pearly-white lateral spots on the abdomen and pearly bluish-white patches on the anterior surface of each femur.

Female Head.—Entirely clad with broad spatulate scales which in front for about half the total distance from vertex to occipital foreman are a deep rich blue while on the hinder part the colour is dark blue-black; in a fresh specimen the blue colour is very marked but after death in some specimens this colour fades assuming a bluish-white shade though even here in certain lights the deeper shade can be obtained. The posterior margin of this blue band is straight, running transversely across the head; in some lights the central part only of the band shews blue the sides appearing white but a shift in the position will bring out the blue at the sides as well. In one specimen some of the scales shew bronze and purple tints but the predominant colour best seen under a hand lens is the deep blue. The scales behind this band are purple-black or purple-bronze in some lights. On the nape are two or three rows of very broad topped upright forked scales; vertical and orbital bristles brown. Basal joint of antenna dark brown and nude, remaining joints dusky, with numerous silky-white downy hairs and long black verticillate hairs. These hairs are longer than is usual in a female. Clypeus dark brown and nude. Palpi about one-ninth of the proboscis (?) five-jointed. There appear to be three very short basal joints followed by two joints of about equal length or it may be only one joint; the terminal joints are thickly clad with dark purple-brown scales. Proboscis of great length as long, or longer than the whole body, slender and clad with purple-brown scales.

Thorax.—Prothoracic lobes light yellowish-brown, clad with broad black spatulate scales with truncated ends and a row of black bristles. Mesonotum shiny yellowish-brown, almost orange towards the centre but ochraceous over the shoulders, thinly clad with black hair-like scales, and a patch of about three or four broad spatulate scales on either side of the bare space in front of the scutellum; bristles light brown. Scutellum light yellowish-brown with black scales which are as broad as long and have square ends; scutellar bristles light brown two on the central lobe but there are scars which shew some have been removed. Four is probably the normal number. Pleura with a large dark brown central patch surrounded by ochraceous margins. Running vertically down the centre of the dark area (which occupies two-thirds of the total area of the pleura) is a line of broad spatulate pearly-white scales, this pleural patch and its band of scales is very conspicuous by reason of the light coloured parts bordering it. Wings smoky clad with dark sepia-brown scales. All the veins have a double row of rather long narrow median scales and all have lateral scales even the sixth which are linear except on the fork cells where they are larger and clavate; first fork cell a trifle longer and narrower than second, its base nearer the wing apex, its stem about as long as the cell; posterior cross vein shorter than median and distant about twice its own length from that vein. Coxæ pale ochraceous with pale bristles and elliptical pearly-white scales; femora clad with dark purple-brown scales; on the fore femora is a thin line of golden scales running down the basal half of the anterior surface and on the apical half are two oval patches of pearly bluish-white scales one about the junction of middle and apical thirds, the other a short distance from the apex; the mid and hind femora shew similar patches but the mid has also a narrow line of white scales on the basal half of the anterior surface and both it and the hind femora are clad with ochraceous scales on the

ventral surface; there is no other marking on any of the legs the remainder of all being clad with the dark purple-brown scales; ungues equal and simple on all the legs.

Abdomen.—Slender; entirely clad with rich purple-brown scales with large pearly-white apical lateral spots; venter clad with pale golden scales. The spots almost meet above in some specimens but never enough to give the appearance of banding.

Male.—Antenna slightly plumose last two joints elongated. The pearly-white patch on the side of the head is more marked the proboscis is longer and the fore and mid ungues unequal the larger unguis shewing a minute process in place of a tooth; the scales on the fork cells in the wing are broader than those on the female wing, and the lateral patch on the eighth segment is much larger than any of the others.

Occurrence.—Described from a series of males and females bred from larvæ taken from water in bamboo at Bukit Kutu and Ulu Klang.

Remarks.—The light orange-coloured mesonotum the black scaled prothoracic lobes and the narrow wing scales constitute a ready means of distinguishing this mosquito from *C. Similis*, which has a black mesonotum and silvery scales on the prothoracic lobes. From *C. Hybrida* it is distinguished by the colour of mesonotum, and the colour of the scales on the prothoracic lobes and on the mesonotum.

Colonemyia Similis. n. sp.

A large patch of deep ultramarine-blue scales on the upper part of the head in front, with dark purple scales behind and at the sides. Thorax dark brown. Proboscis very long. Abdomen with broad pearly-white lateral spots largest on second, fifth and seventh segments. Femora with pearly-white spots.

Female Head.—Dark blackish-brown entirely clad with spatulate scales set in imbricate rows. In front stretching from the vertex backwards to about one-third of the distance between vertex and occipital foramen is a large patch of scales which are deep ultramarine-blue in the living specimen but may fade to a paler blue or almost white in the dried specimen; the patch is semi-circular towards the nape, and it is bounded by dark purple-brown or bronze scales which extend back to the occipital foramen and laterally down the orbital margin; beyond these on the orbital margin there is a patch of pearly-white scales. The blue scales vary with the direction of the light looking almost white in some lights in others a beautiful violet. There are two or three rows of dark brown upright forked scales behind on the nape. Basal joint of antenna bright brown with a few black hairs on the inner face and one or two small scales below these hairs, second joint with small scales dark brown in colour, remaining joints dusky-brown with white downy hairs; verticillate hairs long, dark brown in colour. Clypeus dark brown with a few short hairs on its upper surface. Palpi about one-seventh the length of the proboscis, joints concealed by scales dark brown in colour. Proboscis of great length, as long as the whole body, clad with dark purple-brown scales.

Thorax.—Prothoracic lobes dark brown clad with silvery flat scales on the postero-external surface and a row of bristles in front of these. Mesonotum dark brown to almost black in certain lights thickly covered with long tawny-brown narrow scales but little if at all curved, lanceolate in shape; bristles light brown. In front of the scutellum and over the roots of the wings the scales are very long and hair like. Scutellum tawny at the margins darker towards the base, entirely clad with broad spatulate brown scales; bristles light brown, two present on the central lobe others probably having been knocked off. Pleuræ with a large black area in the centre surrounded by brown, the whole of which is clad with flat scales silvery-white though in parts they take the colour of their background. Wings brown, veins clad with dark sepia scales; spinose scales on anterior edge of costa; subcosta runs so close to costa and first long vein that the three make a dark scaled area making it very difficult to say how each vein is scaled; the apical one-third of the first vein, the branches of the fork cells, and apical two-thirds of the third vein are all heavily scaled with a single median row and lateral scales elongated spatulate elsewhere the lateral scales are narrow and more linear in shape; fork cells of about equal breadth, and with level bases, the first is longer than the second, its stem is two-thirds the length of the cell; median and posterior cross veins of about equal length the latter distant its own length from the median. Fringe scales short. Coxæ light yellowish-brown. Fore femora dark purple-brown above and laterally creamy-white beneath. On the anterior surface are two pearly-white ovoid spots one near the apex the other in the middle. Mid femora similar to the fore femora; hind femora creamy-yellow all round at the immediate base beyond this brown above and creamy-yellow below with two pearly-white spots as in the mid femora, remainder of all legs dark purple-bronze; ungues equal and simple.

Abdomen.—Dark purple-bronze above with large glistening pearly-white lateral spots which almost meet above giving the appearance of a band at the apex of segments two to five inclusive. The spots on the second segment occupy the whole of each side of the segment, they are straight below, and along the apical margin of the segment but the upper edge is concave. The apex of the terminal segment is fringed with pale golden hairs.

Male.—In the male the antennæ are pilose but appear almost plumose by reason of the shortness of the joint with light brown plumes and the two last joints are elongated. The palpi are about one-ninth the length of the proboscis. The fore and mid ungues are unequal and I believe the larger unguis on the fore leg is toothed but the specimen does not shew this well. There are no other differences to be made out except of course the genitalia which seem to consist of a basal piece and a single clasper attached to its apex.

Occurrence.—The female specimens from which this description is drawn are damaged. It has been necessary to take more than one specimen as a type. They were all caught in the bungalow at Bukit Kutu during the afternoon. They never seem to bite. I did not see many there but numerous specimens were also taken at "The Gap."

Remarks.—Though very closely resembling the preceding mosquito it is easily told by the much darker thorax the white scaled prothoracic lobes and the larger and heavier wing scales.

Colonemyia Hybrida. n. sp.

Head clad with large dark purple spatulate scales with rounded ends with a narrow pale yellow margin to the eyes and a few black upright scales on the nape. Thorax dark purple clad with long narrow hay-coloured scales and with flat blue ones on the prothoracic lobes. Antennæ with reddish-yellow basal joints. Pleuræ dark purple with silvery flat scales. Femora with. two large oval silvery spots. Abdomen with large pearly lateral spots.

Female Head.—Clad with large spatulate scales with rounded ends in imbricate rows, dark purple in colour with a narrow pale margin along the eyes which varies in colour from pale creamy-yellow to white or even deep blue according to the direction of the light; on the nape are about two rows of purple-black upright forked scales; vertical bristles brown, paler at the base than the apex; orbital bristles black. Basal joint of antenna light reddish-yellow without scales; second joint swollen, pale at the base, dark brown beyond, with a ring of pale spatulate scales and some long hairs; remaining joints brownish-black with dark purple-brown verticillate hairs. Clypeus purple above with a well-marked light yellowish rim beneath; downy. Palpi about one-eighth the length of the proboscis clad with dark purple-brown scales. Proboscis longer than the whole body; slender, and of equal thickness throughout.

Thorax.—Prothoracic lobes dark brown clad with deep violet-blue spatulate scales. Mesonotum dark purple thickly clad with long hair-like scales which are of a hay colour, bristles not very conspicuous dark brown in colour. Scutellum yellowish-brown, clad with very broad spatulate scales whitey-brown in colour. Pleuræ dark purple-brown in the centre, pale brown at the margins, clad with large spatulate silvery scales. Wings brown with the veins clad with brown scales spinose on the costa; median scales long and narrow with square ends, lateral long linear; first fork cell longer and narrower than the second, longer than its stem by about one-fourth its length; bases of cells practically level; posterior cross vein longer than median distant from that vein rather more its own length. Coxæ pale ochraceous with silvery spatulate scales; femora dark purple-brown above, creamy-yellow beneath, with two large ovoid pearly-white spots on the anterior surface of each; remainder of all legs with dark purple-brown scales. Ungues simple and equal.

Abdomen.—With dark purple scales above, with bronzy reflections, and silvery-white apical lateral spots; venter pale yellow. Male unknown.

Occurrence.—Described from one female caught at Bukit Kutu.

Remarks.—Quite distinct from the two last. The absence of the blue band on the head, the presence of blue scales on the prothoracic lobes, the dark purple thorax, narrower wing scales, and smaller lateral abdominal spots are characters that readily distinguish it.

Genus 13.—**Topomyia.**—NOV. GEN.

Moderate-sized mosquitoes with very long legs and slender bodies. The males are so slender that in flight they look more like floating gossamer than living insects. Male and female antennæ pilose. Male genitalia usually very prominent, resembling those often seen among the tipulidæ. Head clad with large spatulate scales and generally a small patch of silvery racquet-shaped scales on the vertex, but there are no upright scales. Thorax with a central line of silvery iridescent scales of a peculiar shape (broadly ovate perhaps best describes it) and narrow lanceolate scales elsewhere. Scutellum with broad racquet-shaped scales. Proboscis of moderate length; palpi very short. Wings with very long fork cells as long as the fork cells of a typical culex, and lateral scales which are either linear or clavate.

Remarks.—Nine species are at present known and all are found only in the neighbourhood of jungle streams. This genus is closely allied to *Zeugnomyia* and *Colonemyia.*

TOPOMYIA MINOR. N. SP.

Large semicircular patch of pearly-white iridescent scales on the vertex and upper surface of head, the rest of the upper and the lateral surface clad with scales which may look black or bronze-purple according to the amount of light. Thorax with two rows of elliptical pearly scales which occupy the middle half of the median line, black narrow-curved scales elsewhere. Prothoracic lobes very conspicuous as silvery-white spots and a large silvery patch on the scutellum. Abdomen with dark brown scales above, silvery ventral scales and conspicuous silvery lateral patches to the segment.

Female Head.—The greater portion of the upper surface occupied by a patch of pearly-white racquet-shaped iridescent scales which extends to the vertex and has a semicircular outline behind, the rest of the upper and the lateral surfaces are covered with black spatulate scales closely set in imbricate rows; orbital bristles two, black in colour and sometimes fading to brown with drying. Basal joint of antenna black, with silvery tomentum, remaining joints black, with short silvery hairs and black verticillate hairs. Clypeus black. Palpi short, black scaled. Proboscis of moderate length clad with black scales.

Thorax.—Prothoracic lobes very conspicuous, black, clad with brilliant pearly-white iridescent scales and black bristles. On the upper part these scales are racquet-shaped but on the lower portion they are elongated elliptical. Mesonotum black with a purple sheen; the middle half of the central line is occupied by a broad band of pearly-white iridescent scales which is broader behind than in front; the rest of the mesonotum is thickly clad with black narrow-curved scales which in a good light shew purple reflections; there are a few elliptical silvery scales on the shoulders behind the prothoracic lobes. Scutellum almost entirely covered with pearly-white scales, there are a few dark purple scales on the extreme outer margins, and with four central bristles, two parallel, two divergent. Pleuræ pale at the insertion of the wings, dark brown elsewhere, clad with large pearly

racquet-shaped scales. Wings with linear lateral scales, fork cells of equal breadth, first nearly twice as long as the second, its base nearer the wing base, its stem scarcely more than one-third the length of cell; posterior cross vein fully one-and-half times its own length from the median. Coxæ pale ochraceous clad with pearly-white scales; femora silvery beneath, above and at the sides clad with purple-brown scales; remainder of all legs purple scaled; ungues equal and simple.

Abdomen.—Rich purple above, silvery beneath. A large triangular lateral spot present on either side of segments two, four and five, on segments six and seven the spot is more linear and extends more on the dorsum nearly meeting its fellow of the opposite side.

Male.—The male differs in having a longer and more slender abdomen. The genitalia are complex. The inferior claspers are represented by a long thin chitinous rod.

Occurrence.—The specimens were taken in jungle near Kuala Lumpur in the immediate neighbourhood of streams.

Remarks.—Both the male and female when settled have a curious way of dancing up and down very characteristic of many tipulids but not common amongst mosquitoes. It is a very beautiful mosquito easily recognised from all the other Topomyias by the thoracic ornamentation the very large area of the head clad with white and the white scaled scutellum. It is the smallest member of the genus and perhaps one of the most distinct.

Topomyia Decorabilis.

Thorax dark brown, with a central line of ovoid almost circular pearly-white scales with mauve tints; silvery scaled shoulder patches, and dark bronze narrow scales elsewhere. Head with purple-black scales and very small lateral white spots. Palpi short. Proboscis rather long. Abdomen with purple dorsum triangular lateral patches and silvery venter. Male with very slender body.

Female Head.—Head entirely covered with large broad spatulate purple-black scales which in oblique light become deep olive-green; on the vertex there is a small triangular patch which is in a fresh specimen silvery-white but in the type has become black because the scales no longer reflect light and simply take the colour of the background (it is still white in the male), on either side is a small patch of silvery scales adjoining the orbital margin; there are no upright scales; vertical bristles two in number, reddish-brown in colour; orbital bristles dark brown. Basal joint of antenna dark apricot with silvery tomentum, and with hairs but no scales on the inner face, second joint pale at the base, with a few black scales, black at the apex, remaining joints black, with black verticillate hairs. Clypeus dark chestnut-brown. Palpi very short about one-eight the length of the proboscis clad with black-brown scales. Proboscis rather long similarly clad.

Thorax.—Prothoracic lobes deep black-brown, hinder surface clad with long spindle-shaped bluish-white scales. Mesontum dark brown clad for the most part with narrow-curved scales which under a hand lens are metallic-bronze, but under higher powers appear deep rich brown with

paler tips; in the centre there is a line composed of two rows of flat scales broadly elliptical but with pointed ends; in colour they vary from a pale mauve to silvery-white; on each shoulder behind the prothoracic lobe is a patch of spindle-shaped creamy-yellow elliptical scales, and there are few spatulate silvery scales in front of the wing; in front of the scutellum the narrow-curved scales become very long and lighter brown in colour. Scutellum reddish-brown with a broad line of silvery scales in the middle which at the base are obovate but towards the apex become longer and squarer in shape, and purple scales on either side and on the lateral lobes; bristles reddish-brown, as some are denuded their number cannot be determined as the scales cover the scars. Pleuræ light brown covered with flat silvery scales. Wings with brown scales which when massed as on the costa are rich purple: median scales consisting of a double row closely applied to the vein in shape spatulate being about twice as long as broad but varying a little on the different veins, those on the sixth vein being smaller and longer in proportion to their breadth; the lateral scales on the branches of the second and fourth veins and on the apical two-thirds of the third vein are rather broad and approach a spindle-shape though the ends are too blunt, elsewhere the lateral scales are narrower; fork cells long of about equal breadth, the first longer than the second, its base nearer the wing base, its stem rather less than half the length of the cell; posterior cross-vein about half its own length distant from the median. Coxæ pale brown with broad silvery scales roughly triangular with rounded ends. Legs clad with dark purple-brown scales except on the under sides of femora which are silvery brown; ungues simple and equal on all the legs.

Abdomen.—Dorsally clad with dark purple-brown scales, ventrally with silvery scales; laterally there are large triangular silvery spots.

Male.—The male differs in no way from the female except in the genitalia and as these are too much withdrawn to be seen I cannot describe them. Like all members of this genus the male has antennæ similar to those of the female.

Occurrence.—Described from one male and one female both taken in the jungle at "The Gap."

Remarks.—This specimen is easily identified by the breadth of the wing scales and the lateral spots on the abdomen. It was caught resting on a leaf overhanging a stream in the jungle. They certainly are not active blood suckers as I have never known one attack me.

Topomyia Argentoventralis. n. sp.

Head with a large pearly-white spot on the vertex very small lateral white spots, elsewhere black. Palpi black. Median thoracic stripe does not quite reach the base of the scutellum. Prothoracic lobes and shoulders white scaled. Pleuræ dark brown. Abdomen clad with purple scales and brilliant pearly-white scales below which take a yellow tinge from their background when the specimen dries; a patch of pearly-white scales on the dorsum of second segment and triangular pearly-white spots on each side of segments four, five and six, the bar or spot of each nearly meeting its fellow of the opposite side on the dorsum. Male with lateral abdominal spots much reduced.

Female Head.—On the vertex is a patch of broad white scales semi-circular in shape and lower down laterally, adjoining the orbital margin of either side is a very small spot of white scales, all the rest of the head is clad with black scales of the generic type; there are a few black upright forked scales behind; vertical bristles absent, orbital black. Basal joint of antenna black and nude, remaining joints black with short white hairs and black verticillate hairs. Palpi and proboscis covered with black scales the palpi being about one-eighth the length of the proboscis.

Thorax.—Prothoracic lobes black covered with pearly-white broad elliptical scales and with a well-marked row of black bristles looking outwards and forwards inserted on the antero-external face. Mesonotum black with a central line composed of two rows of broad almost circular scales pearly-white iridescent colours in some lights, patches of white elliptical scales on the shoulders behind the prothoracic lobes and dark bronze-brown narrow-curved scales over the rest of its surface. Scutellum brownish-black, central lobe clad with racquet-shaped pearly-white scales, lateral lobes with spatulate dark brown scales; four bristles to central lobe, two median parallel, and set close together, the two lateral far apart and widely divergent. Pleuræ very dark brown to black; a paler yellowish patch beneath the wings and the portion projecting between the fore and mid coxæ. There is a large patch of pearly flat scales covering the central area. Wings brown with dark brown scales with purple reflections; median and lateral scales of much the same shape but the median are rather broader and shorter; lateral scales long, broadly linear towards the apex of the veins; the apices are slightly broader than the bases of the scales; first fork cell longer but not narrower than the second, its base considerably nearer the wing base, its stem rather more than one-third the length of the cell; supernumerary vein a little nearer the base of the wing than the median transverse; posterior transverse vein longer than the median and about its own length from it. Coxæ pale yellowish-brown clad with silvery spatulate scales and dark brown bristles on the fore and mid pale yellowish-brown scales on the hind; all legs clad with dark purple-brown scales the under sides of the hind femora having a narrow line of pale scales. Ungues equal and simple on all legs.

Abdomen.—Clad above with dark purple-brown scales, and on the venter with glistening pearly-white scales with metallic lustre in the freshly killed specimen but after drying they take a yellowish tinge from their background and to some extent lose their pearly lustre; on the dorsum of the second segment is a large patch of white scales and at the base of the fourth, fifth and sixth segments on each side is a band of pearly-white scales which appear on the dorsum but do not meet.

Male.—The male differs in having no white scales on the scutellum, no white patch on the dorsum of the second segment and very slightly marked, lateral bands on the fourth, fifth and sixth segments. The lateral scales on the branches of the second vein are rather more clavate than in the female. The antennæ are pilose, the ungues equal and simple. The lobes bearing the claspers are very conical in shape the eighth segment much enlarged laterally but the finer details of the genitalia cannot be made out in the specimen.

Occurrence.—I have a series of the females and two males all taken at "The Gap" all in the immediate neighbourhood of jungle streams.

Remarks.—I have no absolute surety that the male here described is really the same species as the female but it closely resembles the female. It is possible that *Topomyia Tipuliformis* is the male. The vertical spot in *T. minor* is much larger relatively and absolutely than in *T. Argentoventralis* there are large triangular lateral spots on the first three segments of the former as well as the three bands on segments four to six present on the abdomen of both. The central line in minor is much broader being composed of four or five rows of scales and does not cover the first or last quarter of the middle line of the mesonotum. From *T. Argyropalpis* it is distinguished by the absence of white scales on the proboscis and palpi. And a slight difference in the position of the cross vein on the wing but the two species resemble one another very closely.

Topomyia Argyropalpis. n. sp.

Thorax with bronzy narrow scales and a central line of pearly-white round flat scales. Head with a large pearly-white patch on the vertex. Palpi pearly-white above. A white spot on the scutellum and large triangular pearly-white basal patches on the abdomen. Legs unbanded.

Female Head.—A patch of almost circular pearly-white scales on the vertex, the rest of the head being entirely covered with broad racquet-shaped scales purple-bronze in colour; no upright scales; vertical bristles long, black in colour. Basal joint of antenna without scales, remaining joints blackish-brown with dark brown verticils. Palpi dark brown at the base silvery-white for the apical two-thirds, about one-fifth the length of the proboscis. Proboscis about as long as the abdomen rather slender, clad with dark brown scales.

Thorax.—Prothoracic lobes black, entirely covered with pearly-white circular scales. Mesonotum black with a line of pearly-white circular scales running down the centre the parts on either side thickly clad with bronze narrow-curved scales. Scutellum black with broad almost circular scales, pearly-white on the middle lobe, dark purple-brown on the lateral lobes. Pleuræ dark brown with patches of elliptical silvery scales. Wings brown with dark brown scales, median scales narrow spatulate, lateral longer but similar in shape; fork cells long, first twice as long as its stem, much longer than the second, breadth of two cells equal; posterior cross vein about its own length from median. Coxæ light yellowish-brown with silvery scales. Hind legs with pale ochraceous scales on the basal third and beneath for the whole distance, the rest of the leg with dark brown scales with coppery and bronzy reflections, mid leg with brown scales, fore legs damaged; mid ungues equal and simple. About the middle on either side of the metanotum there seems to be one small scale inserted but it is difficult in the type to be sure it is inserted and not merely lying on the metanotum. Having only one female I cannot confirm this.

Abdomen.—Above clad with dark purple scales, below with metallic-silvery scales which in a dried specimen take on a yellowish tinge the colour of the background; laterally there is a large pearly-white spot

on either side of the second segment and a smaller triangular spot at the base of the fifth and the sixth segments. In the fresh specimen all the white scales have a beautiful pearly lustre and shew iridescent colours with changes of light.

Male.—The median thoracic line does not run to the base of the scutellum but stops a short way from it. The patch of white scales on the middle lobe of the scutellum is much smaller than that on the scutellum of the female. The lateral spots are not present on the abdomen. The antenna and ungues are the same as in the female. The palpi are brilliant white and the proboscis is white beneath as in the female. The genitalia are very complex. There is a pair of inferior claspers shaped something like a two-pronged hay fork. The eighth segment is considerably enlarged from side to side. The lobes carrying the claspers are large convex outwards concave inwards.

Occurrence.—A single female specimen only was caught by a stream in the jungle five miles from Kuala Lumpur, the male was taken at "The Gap" also by a stream. The female was captured in March the male in April.

Remarks.—Resembles *T. Argentoventralis*, the white palpi however serving to distinguish it. Were it not for the marked difference of the male genitalia in the two species one would class it merely as a variety of the latter, but the above characteristic separates the two at once. Many species of the genus Aioretomyia can only be separated by the differences of the male genitalia.

Topomyia Rubithoracis. n. sp.

Head clad with purple-black broad spatulate scales a small patch of pearly-white scales on the vertex and a large patch on either side. Thorax reddish-brown with a central pearly stripe running the whole length and continued on to the scutellum. Dorsum of abdomen purple-brown, venter dull-white the two colours separated by a perfectly straight line.

Female Head.—Clad with purple-black broad spatulate scales; on the vertex there is a very small pearly-white spot and on either side low down a large square patch of pearly-white scales not seen from above; vertical bristles absent but a few black orbital present. Basal joint of antenna black with a few silvery hairs, remaining joints dusky with short black verticillate hairs. Palpi very short clad like the proboscis with purple-black scales.

Thorax.—Prothoracic lobes dark brown clad with broad elliptical silvery scales which may lose their lustre and colour when dry. Mesonotum variable, either light reddish-brown or dark chestnut; there is a central stripe of pearly almost circular flat scales composed of two rows, elsewhere the mesonotum is clad with bronze narrow-curved scales and patches of scales on the shoulder which take the colour of their background and are inconspicuous. Pleuræ light brown, lighter than the mesonotum clad with silvery elliptical scales. Wings with small scales brown in colour, the lateral short and very narrow, the median small and clavate; fork cells of equal breadth, first about one-fifth longer than the second, the stem of the first is one-third the length of the cell; median cross vein shorter than either of the others; posterior cross vein distant from median its own length; spurious vein between fifth and sixth unusually well-marked in its whole length.

Scutellum with a narrow central white stripe and dark brown scales on either side. Coxæ similar in colour to pleura clad with rather long fusiform silvery scales: all the legs clad with dark purple-brown scales.

Abdomen.—Dark purple-brown dorsally, dirty-white below no lateral spots the line where the two colours meet is absolutely straight and unbroken.

Male.—The abdomen is longer and more slender. The proboscis is clad on its ventral surface with yellow scales in all other respects the male resembles the female. The basal lobes of the genitalia are short and clad with golden-brown hairs. There is an inferior pair of claspers as in most of the males of this genus.

Occurrence.—Described from two males and a series of females.

Remarks.—The female can hardly be mistaken for any of the other species the light reddish-brown thorax and pleuræ the dull colour of the scaling of the abdomen and absence of all bands or lateral spots being peculiar to this species. The specimens were taken in the jungle at "The Gap" in the immediate neighbourhood of streams.

Topomyia Gracilis. n. sp.

Head with broad black racquet-shaped scales with rather square ends white vertical patch and small white lateral patches. Central white thoracic stripe extending the whole length of thorax; small white spot on the scutellum of the female. Abdomen without lateral spots.

Female Head.—Black scaled with a large semi-circular patch of pearly-white scales on the vertex and some white scales laterally; orbital and vertical bristles black. Basal joint of antenna black, without scales, remaining joints blackish-brown with black verticillate hairs. Palpi and proboscis black scaled.

Thorax.—Prothoracic lobes with pearly-white elliptical scales on the postero-external surface. Mesonotum almost black with pearly-white central stripe of almost circular scales extending the whole length and dark brown narrow-curved scales over the rest of its surface which under a hand lens appear metallic-bronze. Scutellum dark brown with a few white scales on the central lobe and dark brown scales on either side of these and on the lateral lobes; bristles dark brown. Pleuræ dark brown with broad white elliptical scales. Wings with dark brown scales the lateral narrow with rounded ends, the median also narrow and long but shorter than the lateral; fork cells of equal breadth, first longer than the second, its base nearer the wing base, its stem rather more than one-third the length of the cell; posterior cross vein one-and-half its own length from the median. Coxæ ochraceous with silvery scales; femora silvery beneath; remainder of all legs clad with dark brown scales.

Abdomen.—Dark brown above silvery below, without lateral spots or bands.

Male.—Genitalia complex. Inferior claspers consist of a rounded rod of chitin with a truncated end and one long spine at right angles to it; there are no hairs on this portion. Besides a long falciform clasper attached to the inner side of the end of the basal lobes there is a golden-brown

chitinous rod with a fimbriated end attached to the outer angle on the ventral surface; and there is another process similar to this attached on the ventral surface of each lobe about half way from the base.

Occurrence.—The specimens were taken at "The Gap" in May.

Remarks.—The male genitalia of this species differ so much from that of T. Nigra which in other respects it closely resembles that I feel sure it is a separate species. The female also differs by the much smaller scutellar spot and the paler coxæ.

Topomyia Nigra. n. sp.

Head with a semi-circular patch of pearly-white scales on the vertex, a small patch of similar scales on either side, and black scales elsewhere. Thorax with central pearly-white stripe of flat scales and narrow curved scales over the rest of the mesonotum. Scutellum almost entirely clothed with white scales. Abdomen with silvery venter. Femora silvery beneath.

Female Head.—Black; on the vertex is a semi-lunar patch of pearly-white racquet-shaped scales and low down on either side are a few white scales, elsewhere the head is clad with black flat scales and a few black upright scales behind. Basal joint of antenna black with silvery tomentum, remaining joints with a narrow white ring at base and apex; verticillate hairs black. Palpi clad with black scales which in a good light shew violet reflections. Proboscis black scaled except on the ventral surface which is silvery.

Thorax.—Prothoracic lobes black, clad above and behind with white racquet-shaped scales with a row of bristles in front. Mesonotum black (in a good light it is more of a brown) with a central stripe running the whole length composed of two rows of flat pearly-white almost circular scales and black (bronze under a hand lens) narrow-curved scales over the rest of its surface. Scutellum clad on the central lobe with pearly-white flat circular scales, on the lateral lobes with blackish-brown scales: the whole scutellum is covered there is no bare space between the lateral and central patch; bristles black. Pleura black or very dark brown clad with elliptical pearly scales. Wings densely clad with very dark brown scales, the lateral scales linear and towards the apex of the wing clavate but not markedly so; first fork cell longer than second, its stem about one-third the length of the cell; posterior cross vein nearly twice its own length from the median. Coxæ dark brown with silvery scales; femora, especially the hind, silvery scaled on the ventral face, above and laterally clad with dark brown scales fore and mid legs dark-brown; ungues equal and simple.

Abdomen.—With dark purple-brown scales above, glistening pearly-white scales below with a yellowish tinge in the dried specimens, no lateral spots.

Male.—Male very black, without white spot on the scutellum, central thoracic stripe stops short before it reaches the base of the scutellum, the prothoracic lobes appear more prominent though this may be simply because the specimen is a better preserved one than the female. The genitalia consist of the usual parts in this genus. The tuft of hairs on the end of the genital lobes is more spread out and much paler in colour than in

the male Topomyia Gracilis and the inferior claspers have fimbriated extremities quite unlike the blunt truncated end of the same parts in Gracilis.

Occurrence.—The males and females of this species were taken by a jungle stream at Ampang about six miles from Kuala Lumpur in May.

Remarks—This species closely resembles *T. Gracilis*, but the female differs in being blacker and having a large white spot on the scutellum and the male differs in the genitalia. Its size and lack of lateral abdominal spots distinguishes it from *T. Minor* and the lack of abdominal spots from *T. Argentoventralis*. From *T. Dubitans* it is distinguished by the length of the fork cells, the narrower lateral wing scales, and the presence of the large scutellar spot.

Topomyia Dubitans. n. sp.

Pearly-white patch on the vertex of moderate size composed of white racquet-shaped scales the rest of the head clad with black racquet-shaped scales. Vertical bristles present. Central thoracic stripe continued over the whole length of mesonotum and extending on to the scutellum. Pleuræ very dark brown. Mesonotum dark-brown. Abdomen dark brown above dingy-white below, without lateral spots.

Female Head.—A moderate-sized semicircular patch of pearly-white iridescent racquet-shaped scales on the vertex and low down laterally a patch of similar scales present on each side; the rest of the head is clad with racquet-shaped black scales, vertical bristles black, there are a few black upright scales on the nape. Basal joint of antenna black, without scales, remaining joints black with black verticils. Proboscis not as long as abdomen clad with black scales. Palpi short and black scaled.

Thorax.—Prothoracic lobes black, the postero-external face clad with silvery broad elliptical scales, the antero-external face apparently nude except for a row of bristles. Mesonotum black or very dark brown, central stripe running the whole length composed of two rows of pearly-white iridescent scales the usual broadly elliptical shape; shoulder clad with small elliptical dull yellowish scales, the rest of the mesonotum clad with black narrow-curved scales. Scutellum with a central line of white scales. Pleuræ similar in colour to mesonotum clad with some elliptical white scales some almost circular. Wings with very long fork cells and distinctly clavate lateral scales, fork cells of equal breadth, first longer than second its base nearer wing base, its stem not more than quarter the length of the cell, posterior cross vein about twice its own length from median. Coxæ light muddy-brown with silvery scales, all legs with dark brown scales with purple reflections except on the under sides of the femora which are pale scaled; ungues equal and simple on all legs.

Abdomen.—Clad above with dark brown scales, purple in some lights, and on the venter with silvery scales which in the dry specimen acquire a more creamy tint. There are no lateral spots.

Occurrence.—This specimen was taken at the "Gap" in May under the same conditions as the other known members of this genus.

Remarks.—Male unknown. The chief claim to be considered a separate species is the extraordinary length of the first fork cell which is longer than in any other member of this genus being quite four times the length of its own stem and the clavate lateral wing scales. In all other respects it closely resembles *T. Rubithoracis.*

Topomyia Tipuliformis. n. sp.

Abdomen extraordinarily slender being fully one-and-half times as long as the wings and without any ornamentation save an ill-defined dingy white spot on either side of segments five, six and seven. Head clad with black scales with a patch of pearly-white iridescent scales on the vertex and a small spot low down on either side. Thorax black with median pearly-white iridescent stripe and black narrow curved scales. Pleuræ dark-brown. Legs purple-black.

Male Head.—On the vertex a semi-circular patch of pearly-white iridescent racquet-shaped scales with rounded ends and low down on either side is another patch of white scales, the rest of the head covered with closely set black broad scales, vertical bristles absent, orbital black. Basal joint of antenna black with silvery tomentum, remaining joints black with silvery rings at the bases. Palpi very short closely applied to the clypeus, black scaled as is the proboscis.

Thorax.—Prothoracic lobes black with elliptical pearly-white scales and a row of dark brown bristles. Mesonotum black with central stripe composed of two rows of almost circular scales pearly-white with iridescent tints and black narrow-curved scales over the whole of the rest of its surface except on the shoulders which are clad with small circular olive-brown scales. Scutellum dark brown clad with large racquet-shaped scales dark brown in colour. In some specimens some of the central scales are pale or even white. The scutellum is very small not more than two-thirds the breadth of the base of the mesonotum. Pleuræ dark-brown clad with silvery scales some racquet-shaped some almost circular. Wings with brown scales the lateral being short linear scales those at the apex of the wings having their distal ends slightly enlarged; fork cells of equal breadth the first, longer than the second, its base near the wing bases, its stem rather more than half the length of the cell; supernumerary and median cross veins form one line and are of about equal length, posterior cross vein its own length from the median. Coxæ pale yellowish-brown clad with silvery scales. All legs clad with purple-bronze scales. No silvery scales on the ventral surfaces, but the scales on the tarsal joints are distinctly paler and beautifully iridescent appearing almost silvery in some lights.

Abdomen.—Segments elongated clad with dark brown scales with purple reflections, the ventrum and dorsum being clothed alike. On either side of the fifth, sixth and seventh segments is a patch of pale silvery scales only seen in some lights and at no time very distinct though possibly they are more distinct in the fresh specimen.

Occurrence.—Described from several males taken on the margins of a stream in the jungle at "The Gap" and in the dried bed of a stream at Raub.

Remarks.—This mosquito is quite unique as far as my experience goes and cannot be mistaken for any other species. The extraordinary length and slenderness of the abdomen separates it from all the other species of this genus. It is possible it is the male of *T. Rubithorax* but at present I prefer to treat it as separate species of which I have no female. It is very difficult to see on the wing. Several species of tipulidæ closely resemble it on the wing.

Genus 14.—**Hæmagogus.**—Theobald.

Unrepresented in Malaya.

Genus 15.—**Skeiromyia.**—nov. gen.

Proboscis very long. Antennæ plumose in the male pilose in the female. Clypeus heavily scaled. Head clad with large broad spatulate scales. Prothoracic lobes densely scaled with quadrilateral scales. Mesonotum densely clad with spindle-shaped and clavate scales. Scutellum with spatulate scales. Wings with long fork cells and linear lateral scales.

Remarks.—One species of this genus is at present known though it varies somewhat in colour in different localities. In some lights the colours are metallic generally in very soft shades of bronze and purple. The scaling of the thorax is quite unique and together with the scaled clypeus form good generic characters. The larva closely resembles that of Coionemyia both having a peculiar chitinous process on the thorax.

Skeiromyia Fusca. n. sp.

Head clad with large dark bronze spatulate scales and a narrow margin of bluish-grey scales along the eyes. Thorax clad with spindle-shaped and spatulate scales bronze under a hand lens fawn-brown under a 2/3. Proboscis longer than the abdomen. Abdomen and legs with dark brown scales, venter pale.

Female Head.—With a very narrow bluish-grey margin to the eyes, the rest of the head clad with large dark-bronze spatulate scales and a few dark brown narrow curved ones behind. Basal joint of antenna light yellowish-brown, clad with pale, small scales on the inner face, second joint with scales, remaining joints light brown with brown verticillate hairs. Clypeus light brown thickly clad with rather long white scales with rounded ends. Palpi slender, about one-sixth the length of the proboscis and apparently one-jointed, even when denuded. Proboscis very long, longer than the abdomen. Palpi and proboscis clad with scales which appear olive-brown or coppery-bronze with different lights.

Thorax.—Prothoracic lobes brown, clad with small racquet-shaped scales silvery-brown in colour. Mesonotum dark purple-brown clad with fusiform and large spatulate scales over the roots of the wings and at the base of scutellum which are of a light bronze under a hand lens, while under a 2/3 the colour varies, but is always some shade of brown either olive or fawn or bronze-brown ; on the shoulder above the prothoracic lobe, is a large patch of bluish-grey flat scales best seen in the male.

Scutellum brown with large spatulate scales on all the lobes; bristles brown. Pleuræ brown clad with pale grey flat scales. Wings narrow, clad with dark-brown scales spinose in the costa, a double row of small median scales to all veins except the sixth which has only a single row and linear lateral scales, fork cells narrow, of about equal width, the first a little longer than the second, its base a little nearer wing apex, its stem about two-thirds the length of the cell, posterior cross vein less than its own length from median. Coxæ light yellowish-brown clad with greyish flat scales, rest of all legs clad with dark-brown scales with purple and bronze reflections, under sides of hind femora pale.

Abdomen.—Above dark brown, with bronze and purple reflections, on the venter the scales are very pale with a dirty yellowish tinge. There is no abrupt change from one to the other the dark brown scales gradually passing into the paler scales beneath. There are no bands or lateral spots. Metanotum nude.

Male.—Antenna plumose, last two joints elongated. Proboscis as long as the whole body. Fore ungues unequal larger unguis uni-serrate, mid ungues unequal but either not toothed or very slightly so, hind blunt and thick but equal.

Occurrence.—Though the larvæ of this mosquito are decidedly common in bamboos the adult fly has not been taken but all the specimens I have are bred from larvæ.

Remarks.—It is allied to the Wyeomyinæ and is also allied to the Colonemyias, the larva of the two being very like but the scaling of the clypeus and the venation of the wings and mesonotal scaling at once separate it from these genera.

Sub-family **WYEOMYINÆ.**

Characters.—Palpi short in male and female. Antennæ generally pilose in both sexes. Head with spatulate and upright scales only. Thorax usually clad with fusiform and spatulate scales. Metanotum with scales or chætæ.

Remarks.—The distinguishing feature of this sub-family is the presence of chætæ or scales on the *metanotum* and the large size of the scales on the mesonotum. Only a few of the genera are represented in Malaya. Up to the present the larva of no single species of this sub-family has been found here.

Synoptic Table of Genera.

Section I.—Proboscis of normal shape. Metanotum with chætæ only.

(*a.*) Proboscis not as long as the abdomen. Wing scales narrow.....*Genus* 1.—Wyeomyia.

(*b.*) Proboscis longer than abdomen. Wing scales clavate.....*Genus* 2.—Phoniomyia.

(*c.*) Proboscis not longer than the abdomen. Wing scales broad and clavate and sometimes asymmetrical .....*Genus* 3.—Dendromyia.

(*d.*) Proboscis very long. Frons elongated into a conical point. Wing scales broad.....*Genus* 4.—Runchomyia.

(*e.*) Wing scales very broad and asymmetrical. Tufts of erect scales forming paddle-like expansions on tibia and metatarsus of some of the legs.....*Genus* 5.—Sabethes.

(*f.*) Like the previous genus but without the erect scales on the legs and with shorter palpi in the female .....*Genus* 6.—Sabethoides.

Section II.—Proboscis normal. Metanotum with scales and chætæ.....*Genus* 7.—Gœldia.

Section III.—Proboscis jointed in the male; metanotum with scales only.

(*a.*) Apex of male proboscis scarcely swollen..*Genus* 8.—Limatus.

(*b.*) Apical half of male proboscis greatly enlarged. .....*Genus* 9.—Malaya.

Genus 1.—**Wyeomyia.**—*Theobald.*

Head clothed with large spatulate scales thorax with spindle-shaped and spatulate scales; scutellum with spatulate scales. Proboscis about as long as the abdomen. Wing scales more or less linear. Metanotum with chætæ only.

Remarks.—Two species of this genus occur in Malaya but unfortunately no males have been found. The short proboscis and narrow lateral wing scales readily distinguish it from the next two genera. Most of the scales on these mosquitoes exhibit metallic colours specially noticeable in the living specimen.

Wyeomyia Metallica. n. sp.

Thorax light brown, clad with spatulate and spindle-shaped scales metallic-violet-blue. Prothoracic lobes white scaled. Head with dark metallic-purple spatulate scales. Abdomen metallic-purple with silvery lateral spots. A tuft of about sixteen hairs on the metanotum arranged in two superimposed transverse rows.

Female Head.—Entirely covered with large broad spatulate scales rich metallic-purple or blue in colour; on the vertex is a very small patch of silvery scales and a few low down laterally border the orbital margin on either side. The extreme back of the head is concealed by the collar like prothorax and it cannot be determined whether there are any upright scales or not; orbital and vertical bristles dark-brown. Basal joint of antenna black, naked; second joint black, with pale yellow scales on its inner face; remaining joints black with white downy hairs and almost black verticils. Clypeus black and nude. Palpi about one-seventh the length of the proboscis, clad with dark brown scales, purple in certain lights. Proboscis with similar scales.

Thorax.—Prothoracic lobes very large, meeting above and forming quite a conspicuous collar behind the head, completely covered with large racquet-shaped scales which are silvery in front, a few behind being dark brown but shewing interruption colours as the direction of the light varies. Mesonotum brown, densely clad with spindle-shaped and large spatulate scales. These scales are metallic the predominant colour is dark peacock-blue or violet. When seen alive this violet-metallic thorax is quite a conspicuous feature. The scales are very large and those in the centre are chiefly spindle-shaped while those over the wing bases and in front of the scutellum are spatulate. The scutellum is light brown and entirely covered with spatulate scales which are much smaller than those on the mesonotum, the scales on the central lobe get progressively smaller from base to apex, the apical rows being as broad as long and racquet-shaped with rather square ends. In colour these scales resemble those on the mesothorax; scutellar bristles dark brown: four to the central lobe. Pleuræ brown with a purple hue clad with patches of pearly-white scales some rounded and almost circular others longer and spatulate. Wings brown, with a purple hue, clad with dark purple-brown scales; median scales small, double on all veins to the fifth (excl.); lateral scales narrow with parallel edges and rounded ends; first fork cell longer and rather broader than second, its base nearer wing base; posterior cross vein twice its own length from median. Coxæ light muddy-yellow; fore coxæ with rather long silvery scales down the front, mid and hind coxæ with broader scales; remainder of all legs clad with metallic-purple-bronze scales; ungues equal and simple. Metanotum brown, with a tuft of dark brown and golden-brown bristles near its junction with the abdomen. These bristles are arranged in two lines and there are about eight in each line. Abdomen with metallic-purple scales and large triangular basal silvery lateral spots. Venter cannot be seen.

Occurrence.—Described from a single female taken in the bungalow at Bukit Kutu.

Remarks.—It is a very distinct Wyeomyia the light coloured mesonotum and white scaled prothoracic lobes the large lateral abdominal spots and the presence of white lateral patches on the head distinguish it from *W. Funerea.*

Wyeomyia Funerea. n. sp.

Thorax blackish-brown with metallic spindle-shaped and spatulate scales. Prothoracic lobes with dark bronze-purple scales. Small lateral spots on the abdomen. Legs with purple-brown scales.

Female Head.—Clad with large spatulate scales which are dark metallic-purple, in some lights peacock-blue except on the vertex where there is a very small patch of silvery scales. This patch is very small consisting of about six scales; low down laterally there is a patch on either side of about two or three white scales. Back of the head concealed by the collar-like prothorax it cannot therefore be determined whether there are upright forked scales or not; vertical and orbital bristles black. Basal joint of antenna black and nude, second joint with a few pale brown scales on its inner face, remaining joints black with white downy hairs and black verticils. Clypeus black. Palpi about one-sixth the length of the proboscis rather thick, they and proboscis clad with metallic-purple scales. Proboscis about two-thirds the length of the abdomen.

Thorax.—Prothoracic lobes clad with spatulate scales mostly metallic-purple but in the centre of these is a small patch of silvery scales. The prothorax is much more developed than in most mosquitoes the lobes being very large and above almost forming a collar. Mesonotum black, with spindle-shaped scales over the centre and large spatulate ones over the wing roots and in front of the scutellum; these scales are metallic and vary from a deep bronze to purple and peacock-blue, the blue being specially marked in the scales on the shoulder while the central scales are dark bronze-green or purple. When flying in the jungle especially across a patch of sunlight the thorax of this mosquito is conspicuous shewing as a brilliant metallic-violet. Pleuræ blackish-brown with patches of pearly-white scales. Wings brown with brown scales; the lateral are slightly enlarged apically; bases of fork cells level, first a little longer and narrower than second, its stem about two-thirds the length of the cell; posterior cross vein about twice its length from median. Coxæ light muddy-yellow with silvery scales; rest of all legs with dark brown scales with purple reflections; ungues equal and simple. Metanotum blackish-brown; near its junction with the abdomen are three rows of bristles the upper row consists of three the next row of seven the third row of nine bristles placed in a transverse direction. Too much stress must not be laid on the number of bristles as I believe it varies in different specimens and it is difficult in count them accurately. There is an odd bristle below the third row in this specimen which makes about 20 in all.

Abdomen.—Clad with metallic-purple or rose-purple scales with silvery lateral spots triangular in shape and placed at the base of each segment.

Occurrence.—Described from a single female taken in jungle about six miles from Kuala Lumpur.

Remarks.—It is a typical Wyeomyia and easily distinguished from *W. Metallica* by the dark almost black mesonotum the dark scaled prothoracic lobes the slightly clavate lateral wing scales and the different venation.

Genus 2.—**Phoniomyia.**—*Theobald.*

Head with large spatulate scales with ends more rounded than those in Wyeomyia. Male and female antennæ pilose. Proboscis long and slender. Scutellum with rather small racquet-shaped scales. Mesonotum with spindle-shaped and spatulate scales. Wings with long fork cells in male and female and clavate lateral scales. Colours metallic.

Remarks.—One species occurs in Malaya but is not very common.

Phoniomyia Indica.—*Theobald.*

Thorax blackish-brown covered with metallic fusiform and spatulate scales varying with the light from bronze-green to purple-bronze or peacock-blue. Proboscis as long as the abdomen. Prothoracic lobes with white scales above and purple-bronze below. Wings densely clad with dark brown clavate scales. Abdomen purple with silvery lateral spots.

Female Head.—Entirely covered with spatulate scales dark purple in colour; these scales are smaller and their ends are rounder than the cephallic scales in Wyeomyia. On the vertex is a small triangular patch of silvery-white scales the apex of the triangle being posterior and thrust like a wedge into the purple scales; there are a few black upright forked scales behind on the nape. All the scales are metallic and their hue varies with the amount and direction of the light now seeming dark purple now bronze-green. Orbital and vertical bristles black. Basal joint of antenna black, without scales; remaining joints black, with white rings at the insertion of the verticils; there are a few scales on the inner face of the second joint and numerous short hairs on all the joints; verticillate hairs black. Clypeus black. Palpi not one-tenth the length of the proboscis clad with dark purple-brown scales. Proboscis long and slender, as long as the abdomen (which in this mosquito is relatively very long) scaled with metallic-purple scales.

Thorax.—Prothoracic lobes large but not so large as the lobes in the Wyeomyinæ, entirely covered with rather large racquet-shaped scales which on the upper half are silvery-white on the lower dark metallic-purple. Mesonotum dark brown, almost black, entirely covered with spindle-shaped scales except over the wings and in front of the scutellum where the scales are large and spatulate. These scales are metallic, and bronze-green, peacock-blue and purple are the various colours shewn as the specimen is shifted from one position to another. Scutellum dark brown with rather small racquet-shaped dark brown scales; bristles dark brown probably four to the central lobe. Pleuræ dark brown with a broad central vertical line of elliptical silvery scales. Wings brown with dark brown scales, median small and spatulate as many as three rows on the stems of fork cells and the fifth vein and the whole of the third; lateral scales distinctly clavate present on the whole of second and third vein the branches of the fourth and upper branch of the fifth; all these scales shew purple tints. Fork cells of equal breadth, first longer than second, its base nearer wing base,

its stem scarcely half the length of the cell; posterior cross vein rather more than its own length from median. Coxæ dark brown but not so dark as the pleura with silvery scales; hind femora with silvery scales except along the upper surface and the lateral surfaces of the apical fourth; the whole of the fore and mid legs and the rest of the hind legs clad with dark bronze-purple scales; ungues equal and simple. Metanotum dark brown, with a tuft of about 18 bristles close to its junction with the abdomen. These are inserted in two rows one on either side of the middle and these rows run in a vertical direction the bristles in each curving outwards away from the middle line.

Abdomen.—Long and slender. Clad with metallic-purple scales and large silvery lateral spots at the base of each segment.

Male.—The male is in all respects, except of course the genitalia, similar to the female. The same little wedge-shaped patch of white scales is seen on the vertex the same patch on the upper half of the prothoracic lobe. Unlike most mosquitoes the wings are identical instead of following the usual rule in the males of having shorter fork cells and fewer scales. The antennæ are pilose and do not differ in any way from the female; indeed, except for the difference of the genitalia and the presence of the tooth of one of the ungues of the fore leg one would not know the specimen was a male. Perhaps the verticils are a trifle longer than in the female. The basal pieces of the claspers is large, short and very round; and is clad with numerous long ochraceous hair but no scales. Unfortunately the structure of the genitalia cannot be determined.

Occurrence.—Described from two females and one male taken in jungle about six miles from Kuala Lumpur.

Remarks.—It is quite a distinct species and though the proboscis is not as long as the whole body it is distinctly longer than that of any Wyeomyia and the wing scales are broader and clavate so that it corresponds closely to the types of this genus in Theobald's "Monograph."

Genus 3.—**Dendromyia.**—*Theobald.*

Male and female antennæ pilose. Proboscis of normal length. Head clothed with large spatulate and racquet-shaped scales. Mesonotum with fusiform and spatulate scales. Scutellum with spatulate scales. Metanotum with chætæ only. Wings with broad clavate scales often with obliquely truncated ends. Colours metallic. Wings have long fork cells and are as heavily clad in the male as in the female.

Remarks.—Three Malayan species of this genus are known. They are easily told by their broad wing scales and short proboscis. Some of the members of this genus are very common at high elevations. They are all metallic coloured species and all vicious biters.

Dendromyia Communis. n. sp.

Thorax black, densely clad with fusiform and spatulate metallic scales dark bronze-green or bronze-purple in colour. Prothoracic lobes with silvery scales in front, purple behind. Purple scales on the head with a white spot on the vertex and white lateral patches. Coxæ and bases of femora creamy with a brownish tinge. Abdomen with basal lateral spots.

Female Head.—Black, entirely covered with racquet-shaped scales purple in colour. On the vertex extending forwards between the eyes is a patch of silvery scales and a similar patch on either side low down adjoining the orbital margin; behind on the nape are a few upright scales dark purple in colour; orbital and vertical bristles purple-brown. Basal joint of antenna black, with small light brown spatulate scales on the inner surface, second joint yellowish-brown at the base with small scales some of which are dark brown others golden-brown; apical half purple, remaining joints purple-black with numerous pale downy hairs and purple verticils. Clypeus purple, nude. Palpi about one-fourth the length of the proboscis, apparently three-jointed, clad with purple-brown scales. Proboscis about two-thirds the length of abdomen clad with purple-brown scales.

Thorax.—Prothoracic lobes large hollowed anteriorly to allow room for the head the back of which rests against the prothorax; the external face is clad with large flat silvery scales while the surface next to the shoulder is clad with metallic-purple scales. Mesonotum black, densely clad with metallic flat scales which are spindle-shaped and spatulate the predominant colour of which is dark bronze-green or purple. There is no band of silvery scales on the shoulder behind the prothoracic lobe as in Wyeomyia Metallicus. Scutellum entirely covered with large purple and bronzy spatulate scales, some of which have notched ends; the bristles are purple. Pleuræ dark purple with numerous flat racquet-shaped silvery scales. Wings brown with dark scales large broad and oblique ended. Fork cells very long, the first longer but no narrower than the second; its base nearer wing base, its stem about three-fourths the length of the cell; posterior cross vein about one and half times its own length from the median. Coxæ light yellowish-brown with flat silvery scales. The whole of the basal third and the venter of the remainder of hind femora clad with creamy (or pale golden in some lights) scales, the remainder of the hind legs and the whole of the other legs clad with metallic-purple or rose-purple scales; ungues equal and simple.

Abdomen.—With metallic-purple scales and silvery lateral spots which are very large on the apical segments. In the dry specimens the abdominal pleuræ contract and cause the tergite to bend down on either side the lateral spots thus approach each other which gives a false appearance of ventral banding: this is seen in nearly all dried specimens.

Abdomen very slender, with greatly enlarged terminal segments. Antennæ pilose; ungues equal and simple. Ornamentation resembles that of the female.

Occurrence.—Described from a series of females and one male taken at "The Gap," Selangor.

Remarks.—This species resembles Dendromyia Aureochætæ but is easily distinguished by the following differences; the white scales on the prothoracic lobes the absence of the pale brown shoulder patches, the colour of the chætæ on the metanotum and the greater breadth of the wing scales.

Dendromyia Aureochæta.

Thorax black with a brownish tinge clad with large scales which are metallic and shew bronze and purple tints. Head purple scaled with a

white patch between the eyes and a very narrow white margin to the eyes. Prothoracic lobes purple edged with white. Abdomen metallic-purple with silvery triangular basal lateral spots. Wings heavily clad with broad scales many with oblique ends.

Female Head.—Dark slate-grey, entirely covered with large flat scales with rounded ends white on the vertex and along the upper half of the orbital margin, dark purple elsewhere. The scales are metallic and the colour varies with the amount and direction of the light sometimes appearing dark peacock-blue. The white patch on the vertex is very small and occupies the space between the eyes, the white scales along the orbital margin consist of one row near the vertex but more laterally the line broadens though not into a definite patch until it gets round to the cheeks beneath, where it merges into a large patch of silvery scales. Upright forked scales may be present but as the back of the head is concealed by the prothorax this cannot be determined. Basal joint of antenna dark slate-grey with a few small white scales on the upper part of the inner face, second joint purple-black with patch of white scales on its inner face, remaining joints purple-black with numerous short silvery hairs and black verticils. Palpi rather more than one-fourth the length of the proboscis certainly three, probably four-jointed. Clypeus black, naked. Proboscis short not more than two-thirds the length of the abdomen. Proboscis and palpi clad with dark metallic-purple scales.

Thorax.—Prothoracic lobes very large meeting above and forming a collar behind the head, clad with dark metallic-purple scales with an edging anteriorly of silvery scales. Mesonotum black with a brownish tinge entirely covered with spindle-shaped obovate and spatulate scales which are metallic and look dark bronze or purple-bronze or dark bronze-green according to the direction of the light; in front overhanging the prothorax are large spatulate scales and these scales instead of pointing backwards point forwards covering posterior parts of the prothorax above. Large bristles inserted on the prothoracic lobes project outwards on either side of the head. On either shoulder just above and behind the prothoracic lobe of each side is a broad band of creamy-yellow flat scales. Pleuræ dark brown with patches of silvery scales. Wings very densely clad with dark purple-brown scales, where they are massed the colour is purple where single brown; the spinose scales on the anterior edge of costa are numerous and long; the subcosta has broad taeniorhyncus-like scales; on the first long vein and the second and its branches the scales are large broad scales with oblique ends; on the third, and succeeding veins there are broad oblique-ended median scales and long narrow clavate lateral scales; there are no lateral scales on the sixth; fork cells long, first longer and narrower than the second, its base, nearer wing base, its stem about one-fourth the length of the cell; posterior cross vein twice its own length from the median. Coxæ light yellowish-brown with golden bristles and silvery flat scales. Under sides of hind femora silvery, pale golden in some lights; the remainder of hind, and the whole of the fore and mid legs clad with metallic-purple scales; ungues equal and simple on all the legs and almost straight. Metanotum purple; near its junction with abdomen there is a tuft of ochraceous bristles about twenty-five in number the area in which they are inserted being roughly circular.

Abdomen.—Clad with metallic-purple scales. On the venter there are basal silvery bands and laterally there are large triangular basal spots creamy with a silvery lustre. Male unknown.

Occurrence.—Described from a series of females taken in the day time in jungle near Kuala Lumpur, in April and May.

Remarks.—It is a very distinct species and the broad asymmetrical wing scales and the short proboscis with metanotal chætæ shew it to belong to this genus. There are other distinctions between it and Wyeomyia at least the Wyeomyias of this peninsular such as the presence of scales on the basal joint of antennæ the greater size of the mesothoracic scales.

Dendromyia Achætæ. n. sp.

Thorax blackish-brown, clothed thickly with metallic spatulate and spindle-shaped scales purple or bronze-green. Head with dark purple scales in the centre and silvery ones at the sides and on the vertex. Prothoracic lobes and pleuræ with silvery scales. Abdomen purple-bronze above with pearly-white basal bands on the fifth, sixth, and seventh segments and lateral spots to all segments. Chætæ apparently absent from metanotum.

Female Head.—Black, clad with flat scales which are for the most part racquet-shaped. There is a small patch of silvery scales on the vertex and fairly large lateral patches of silvery scales with a bluish tinge; the rest of the head is clad with dark purple-bronze scales, and behind with a few broad-topped upright scales with the free edge serrated, black or dark purple in colour; they are seen with some difficulty as they lie very far back; vertical and orbital bristle black. Basal joint of antenna black with a purple tinge with a few small scales on its inner face, second joint brown at the base, purple at the apex, a tuft of brown scales on its inner face, remaining joints dark purple with silvery downy hairs and black verticils. Palpi about one-sixth the length of the proboscis clad with purple-bronze scales. Proboscis rather long, almost as long as the abdomen, apex fusiform; scaling similar to palpi.

Thorax.—Prothoracic lobes entirely covered with brilliant silvery scales racquet-shaped, rather longer than broad; the lobes are very large but do not quite meet above. Mesonotum purple-black (in some lights there is a brownish tinge) entirely covered with large flat scales fusiform and spatulate; in front numerous scales project forwards overhanging the prothorax above; the dorsum of the mesothorax is somewhat denuded but there is no sign at either end of any ornamentation; there are numerous purple-brown bristles overhanging the wing bases. Scutellum light yellowish-brown with large purple-brown spatulate scales on the lateral lobes and at the base of the central lobe, the apical two-thirds of the latter clad with racquet-shaped silvery scales. There are six bristles to the central lobe which are knocked off in the specimen but the pits for their insertion are perfectly plain. Pleuræ pale brown at the insertion of the wings elsewhere dark purple-brown densely clad with brilliant silvery racquet-shaped scales. Wings smoky, heavily clad with dark brown scales metallic-purple where they are massed as on the costa; the median

scales are broad and about as broad as long enlarged apically, perhaps the term narrow ovate would describe their shape; there is a double row on all veins but the shape is not quite the same on the posterior veins; the lateral scales are broadly linear except on the branches of the fork cells and the apical half of the third vein where they are much broader and distinctly clavate; first fork cell longer than the second, its base a trifle nearer the wing apex, its stem about two-thirds the length of the cell; posterior cross vein about twice its own length from median. Coxæ brown with silvery flat scales and pale brown bristles. Except for a narrow line of purple-brown scales above, the basal two-thirds of the hind femora are entirely white scaled. This white is a totally different white from the glistening pearly or silvery-white of the scales on the pleuræ, abdomen, head, etc; it is a creamy-dead-white. All the rest of the hind leg and the whole of the other legs are scaled with dark metallic-purple-bronze scales. There are longitudinal rows of black spines on the hind femora and tibiæ, and a ventral row of pale golden ones on the fore femora; fore and mid ungues equal each unguis with a large tooth about one-third of the way from its base, hind equal and simple. Metanotum purple-brown. Can be seen quite clearly and presents no signs of chætæ or scales.

Abdomen.—Clad with metallic-purple-bronze scales above. On either side of the base of each segment there is a large triangular patch of glistening silvery scales and on the fifth, sixth, and seventh segments the spots of the opposite sides meet above and form basal bands. These white scales are relatively of great size and distinctly racquet-shaped, I have not seen any abdominal scales quite like them.

Occurrence.—Described from one specimen which is probably female though the genitalia are so entirely concealed and there is so little difference between the sexes in this genus that it might be a male.

Remarks.—There are no chætæ on the metanotum and no signs of there having been any but in spite of this the characters are such that without creating a new genus there is no other place for this mosquito. That it is an Aedine I have not the least doubt as the shape of the head scales are typical. Pending the finding of further specimens I have placed it here.

Genera 4 *to* 8 *inclusive not represented in Malaya.*

Genus 9.—**Malaya.**—NOV. GEN.

This genus is founded on the characters of only one specimen but it is of so remarkable an appearance as to fully warrant a new genus. Proboscis with a distinct joint the apical portion much swollen and clad with long hairs. Head clothed with large racquet-shaped scales; mesonotum with narrow-curved scales; scutellum with racquet-shaped scales. Metanotum with scales. Wings with fork cells of moderate length and clavate lateral scales.—*Malaya Gumrostris. n. sp.*

MALAYA GENUROSTRIS. N. SP.

Thorax very broad, shiny black when denuded. There are a few bronzy narrow-curved scales, but except for these all the other scales have

been ribbed off. Head black with white lateral and vertical patches. Proboscis two-jointed the basal two-thirds creamy-white the apical third swollen, black. Abdomen black scaled with white lateral patches and constricted basally. Metanotum (?) with scales.

Male Head.—Purple; space between the eyes and on the vertex clad with silvery-white clavate scales, which when fresh are iridescent and shew rose and blue tints, on either side is another patch of silvery scales the rest of the head being clad with flat velvet-purple scales with rounded ends. When seen singly these scales have a brown colour. There are no upright scales. Basal joint of antenna light fawn-brown with a silvery frost on it with a few hairs on its inner surface but no scales, remaining joints purple with downy silvery hairs and purple short verticillate hairs no longer than those on the antenna of a female. Clypeus elongated, creamy, with a silvery sheen. Palpi similar in colour and about as long as the clypeus from which they are with difficulty separated as they are so light in colour and so closely applied. They are two-jointed and clad with a few scales which take the colour of their background and can therefore only be seen with difficulty. Proboscis consists of two portions the apical third being hinged on to the basal portion. The basal two-thirds is about half the length of the abdomen and, except just at its apex where it darkens a little, is of a creamy light brown and clad with long hairs but no scales or if with scales they are not easy to detect; the apical third is in the dried state bent upwards but when living the whole proboscis lies along the venter exactly like the proboscis of a hemipterous insect. This apical portion is also clad with long hairs and with purple scales. Anything more unlike the proboscis of a mosquito could not well be pictured.

Thorax.—Prothoracic lobes large dark purple and clad with almost circular glistening pearly-white scales. Mesonotum dark purple; on either shoulder, i.e., the portion of mesonotum lying above the prothoracic lobe on either side there is a patch of circular glistening pearly-white scales. All these white scales become azure-blue or rose-pink in certain lights. The rest of the mesonotum is unfortunately almost entirely denuded but at the margins there are a few bronzy narrow-curved scales left. Scutellum light brown, clad with small racquet-shaped dark brown flat scales. Pleuræ light brown with large purple patches which are densely clad with almost circular pearly-white scales. Wings smoky with brown scales; a single row of small spatulate median scales on all the veins and small linear lateral scales on the anterior veins to the upper branch of fifth (inclusive); fork cells rather long, of about equal width, first longer than the second in the proportion of three to two, its stem about one-third the length of the cell, its base nearer wing base; posterior cross-vein, its own length from median. Coxæ pale yellowish-brown with flat silvery scales. All the rest of the legs clad with coppery-bronze scales except the venter of the hind femora which are pale silvery-brown; apices of tibiæ much enlarged; ungues of fore legs very small apparently equal and simple; mid legs gone; hind ungues simple and equal.

Abdomen.—Basal segments narrow giving the appearance of a waist. This is not due to shrinking but is a natural condition. Most of the abdomen clad with dark velvety-purple scales. On the second, fourth,

fifth and sixth segments there are lateral pearly spots specially large on the second and fourth. Basal portions of claspers yellowish-brown and very hairy. There is apparently only one terminal chitinous hook to each.

Occurrence.—This mosquito was taken by Dr. Daniels in his bungalow verandah in the morning.

Remarks.—This bungalow is fairly close to jungle, an important point to remember. There is no possibility of mistaking this mosquito as the curious proboscis alone would at once distinguish it. It is to be regretted we have no female. In some points this resembles Limatus but I cannot be sure whether the scales seen on the mesonotum really belong to it or have been knocked on to it. Even if there were scales on the mesonotum this mosquito differs so considerably from Limatus as to justify the formation of a new genus. It is evidently very rare. It is possible the female differs so much from the male that even if caught it might not be recognised as the female of this species.

Undetermined Species.

The species here described owing to lack of material cannot be satisfactorily placed. It is therefore simply numbered and not named.

No. 1 Undetermined Species.

Head entirely clad with large spatulate dark and pale brown scales with deep brown upright scales on the nape. Thorax black with brown narrow-curved scales, and golden narrow-curved scales on the scutellum, and in front of the mesonotum. Abdomen with deep blue-black scales and a narrow band of ochraceous scales at the base of each segment. Legs brown with a pale brown band at the tibio-metatarsal joint of the hind leg. Wings with brown broad asymmetrical lateral scales.

Female Head.—Clad with broad square-ended scales of a pale washed-out brown (in some lights golden-brown colour) and dark brown upright scales behind; vertical bristles golden-brown. Basal joint of antenna dark brown with dark brown hairs on its inner face; this joint is very small; second joint golden-brown with a few dark brown scales on its inner face near the base and numerous hairs, very long nearly as long as the three succeeding joints, remaining joints dark brown with numerous short silky-white hairs and rather short dark brown verticillate hairs. Clypeus dark brown. Palpi clad with dark brown scales, about one-sixth the length of the proboscis, four or five-jointed. Proboscis with dark brown scales and yellowish-brown labellæ, rather long, about as long as the abdomen.

Thorax.—Prothoracic lobes dark brown without scales but with a row of long ochraceous bristles. Mesonotum dark brown in some lights, patchy dark brown with lighter brown streaks in others, clad with golden and dark brown scales mingled with a patch of golden scales on the anterior margin and two short lines of golden scales in front of the scutellum. Bristles dark brown. Scutellum muddy-brown with pale flaxen narrow-curved scales and dark brown bristles, six to the central lobe. Pleuræ pale ochraceous with a few colourless scales. Wings with dark brown scales; stem of second long vein clad with a single row of large broad cordate median scales. As it approaches the fork cell some large broad piriform scales are seen some

of which are slightly asymmetrical. These broad clavate scales are also present on the whole of the third vein, and the branches of the fourth and extreme apex of branches of the fifth vein; fork cells short of about equal length; stem of first fork cell about twice as long as the cell; base of second fork cell nearer wing base; supernumerary cross vein set very obliquely, posterior cross vein shorter than the median about its own length from the median running obliquely from in front backwards and inwards. Coxæ and base of femora creamy; hind femora almost entirely creamy scaled; rest of hind leg and all the mid and fore legs clad with dark brown scales with purple reflections. Two rows of long golden spines on hind tibia. Ungues equal and simple on all the legs.

Abdomen.—Dorsally clad with metallic-purple scales with narrow basal bands of ochraceous scales and long ochraceous hairs on the edge of each segment.

Observation.—Described from one female taken in the open in Kuala Lumpur.

Remarks.—As the male is unknown it would be folly to classify this mosquito. The very long second joint of antennæ makes one think of Deinocerites, but the wing scales are so different that it is easily distinguished from members of that genus. It comes very near the genus Mimomyia.

Notes on the Mosquitoes on the River and Coast Districts of the Eastern Side of the Peninsula.

By C. W. Daniels, M.B., M.R.C.S.

The rivers on the eastern side of the watershed are comparatively free from mine tailings but in rainy weather are muddy to some extent. The Pahang River is the largest, but observations were also made on the Kuantan River. One point of resemblance to such African rivers as the Zambesi is that the common mosquitoes belong to the *Mansonia*. The commonest species however is not *uniformis* as on the Zambesi though it does occur but *annulipes* and a third species *M. annulata* is also found.

These mosquitoes were much less numerous than on an African river. *Stegomyia scutellaris* was common in some places and in the vicinity of large settlements only and therefore to be attributed to them *Culex fatigans*.

Anopheles were not found on the boat moored up to the banks during five nights spent on the Pahang River or in two on the Kuantan River and only in the lower reaches were any anopheles larvæ found in pools near the bank and none were found in the river or pools in connection with the river. This is in marked contrast with African rivers where such mosquitoes abound. Considering that several species of anophelina *A. Treacherii*, *A. albirostris*, *A. willmori* and *A. Karwari* are found in streams only and that at least two of these species are abundant in the streams supplying these rivers their absence in the rivers requires some explanation. In the water from the Kuantan the larvæ can live and probably also in long stretches of the Pahang River. The absence of any grass, reeds or sedges growing into or on the surface of the rivers is the probable explanation. Such grasses abound in the African rivers and the larvæ are found in the water between the stems and submerged roots. This form of vegetation prevents the larvæ from being carried away, protects them from fish and probably provides them with food supply.

It is of great importance that the importation of such grasses should be prevented. Malaria on the banks of rivers except towards their mouths is not common or virulent. In Africa such banks are on the East coast the worst placed for malaria. The introduction of grasses of this character might and probably would result in an enormous increase in the unhealthiness of a thickly populated portion of the country.

The common larvæ found in the pools were *C. gelidus*, *nigrocephalus* and *fatigans*. Near the coast the river broadens out and sand banks are numerous and there are backwaters. The numbers of mosquitoes is larger especially of those belonging to the genus Mansonia. No anopheles were found in the river and those found on shore are not river breeders. At the town of Pekan the anophelina *M. Rossi*, *C. Kochii*, *M. Sinensis* and *M. Umbrosus* were found as adults and breeding in pools and more or less stagnant water in and near the town. In this town the commonest mosquito was still *Mansonia* annulipes but *Culex fatigans* and *Stegomyia scutellaris* and *M. uniformis* were also common. *Culex gelidus* and *biauratus*

were the commonest larvæ found in the open country whilst *Culex fatigans* was common nearer the more crowded portions of the town.

On the open flat land in the vicinity of the river pitcher plants were extremely common. The two species have been identified by Mr. Ridley, the Straits Government Botanist, as *Nepenthes Rafflesiana* and *N. gracilis*. In both larvæ were found in great abundance. These include a Teromyia *T. Ater* which like the larvæ of other members of the genus was larvivorous. The other larvæ found include a new species of *Colonemyia* and a *Skeiromyia fusca*. These appear to be carnivorous and to live on the bodies of the dead adult insects so abundantly found in these cups. These mosquitoes though of considerable interest are probably of little importance to man and do not in the adult stage attack him.

At Pekan itself there is comparatively little malaria though it does occur. An examination of 138 native children was made and only 7 had spleens definitely projecting below the ribs. Of children over 6 months but under 4 years out of 69 in 5 the edge was below that of the ribs but only in 3 more than a finger's breadth. Of 59 over 4 but under 10 in 2 only was the spleen definitely enlarged. In 4 others spleen could just be felt.

Along an African river, Zambesi or Shire, the proportion between 2 and 4 years of age with definitely enlarged spleen is about 50 per cent.

At the mouth of the river, Kuala Pahang, there are patches of mangrove and Nipah swamps though the greater part of the shore and the banks of the river are clear sand. There are also cocoanut plantations and ample cocoanuts shells abound. Few mosquitoes were found in the house at the point. Those found were *Stegomyia Scutellaris* and *Mansonia uniformis* and no anopheles. In the empty cocoanut shells and other receptacles larvæ were not as frequently met with as is usual in such places. The larvæ found were those of *Culex maculicrura*, *C. graminis* and *Stegomyia Scutellaris*.

In the crab holes no larvæ and no mosquitoes were found. On entering the mangrove swamp abundant mosquitoes were found. These bite viciously in the day time but remain in shelter and neither enter the houses nor come out into the open. *Verralina Butleri* and *Stegomyia fusca* were the species represented.

The Kuantan River opens into the sea some twenty miles north of the Pahang River. It opens into a bay formed by a promontory of granite jutting out into the sea and a range of granite hills runs nearly parallel to the general direction of the river to the north having a belt of flat sandy soil from one to two miles in breadth between it and the river. Observations were made on each side of the mouth of the river, in the town Kuala Kuantan, and at various places on the range of hills mentioned.

There was excessive rain during the period under review and consequently the flat land was so flooded that little information could be gained as to the more permanent breeding places.

The mosquitoes found in the houses were *Stegomyia scutellaris*, *Mansonia uniformis* and *annulipes* and *Culex fatigans*. No anopheles were seen and no *Stegomyia fasciata*.

In breeding places in the town larvæ of *Stegomyia scutellaris* and *Culex fatigans* were found and in the neighbourhood pitcher plants of the same two species as were found near Pekan and these also contained larvæ of the same mosquitoes. In the mangrove swamps which are more extensive than on the Pahang River *Verralina*, *Butleri* and *Stegomyia fusca* were found. There is little malaria in the town or in the houses on either side of the river bank but near the range of granite hills settlements have been made and have proved to be most unhealthy. These hills are thickly covered with forest and streams are numerous. In this jungle in every place *Stegomyia scutellaris* were abundant and in certain spots *M. Umbrosus* was found in numbers. This mosquito was also found by Dr. LEICESTER outside the drained area at Klang but has not been met with in the interior. In the streams in this jungle *Anopheles treacherii* were found. Near one of the abandoned stations and within thirty yards of the sea *Anopheles treacherii* were found in the stream and also *Cellia Kochii* and *A. sinensis* in a pool. In bottles, empty tins and other artificial receptacles about the camp very numerous larvæ were found and these include *Stegomyia scutellaris*, *Desvoidea obturbans*.

During two nights spent on the river then in flood at points some 20 and 40 miles from the mouth only *Mansonia annulipes*, *M. annulata* and *Tæniorhynchus conopas* were caught.

Higher up at Sungei Lumbing a sufficiently long stay was made for a closer investigation. The river when the flood subsided was quite clear and though a rapid running stream there were plenty of places where quiescent areas were to be met with but no grass growing into the stream. No anopheles larvæ were found in the river and whilst living on the banks of the river no anopheles were seen in the house or other buildings. The river runs through a valley bounded on the south by a range of so-called slate, Andalusite schist. The streams from this slate were not numerous and no anopheles were found in them whilst passing over the rocky bed. Near the valley the streams passed through earth and formed pools, in some such places *C. Kochii* were found in large numbers. In most of the streams on this side no anophelina were found. On the other, the northern, side of the valley the hills were granite and in the streams on this side *A. treacherii* were readily found and lower down the streams *C. Kochii* were found abundantly.

On this, the granite, side anopheles were abundant.

Malaria is rare amongst those working at the settlement of the Pahang Corporation which is on the flat on the slate side of the river but does occur. On the other side, the granite side, it is very common and often severe amongst the woodcutters who live near the foot of the hills more especially so in those living near the granite hills.

In the pools in and around the township and various kongsis *Stegomyia scutellaris* was the abundant mosquito but *Culex fatigans* was fairly common. Other mosquitoes include *C. gelidus*, *C. mimeticus*, *C. vagans*, *C. sitiens*, *C. impellens*, *C. hirsutipalpis* and *C. concolor Uranotania trilineata* and *fusca*. In artificial receptacles *Stegomyia scutellaris* was again the commonest, *Stegomyia fasciata*, *Desvoidea aurolineata*, *obturbans* and *jugraensis* were also found. In

one tub seven larvæ of *Teromyia quasiferox* were found. Two species of *Lophoceratomyia*, *L. pallidus* and Mammilifer and Taeniorhynchus *domestica* and *conopas*.

Much of the ground round the houses and settlement is overgrown with long grass or low scrub. Into this thick growth innumerable tins, bottles and other artificial receptacles have been thrown and it is to this accumulation of rubbish which affords suitable breeding places for mosquitoes that the prevalence near such land of mosquitoes is to be attributed.

The presence of *Stegomyia fasciata* the carrier of yellow fever so far inland is exceptional in this country and is the more remarkable that no specimens of this mosquito were found on the coast.

As compared with the West Coast of the Malay Peninsula there are certain points of resemblance. *Verralina Butleri* and *Stegomyia fusca* have been found only on the East and West Coast and the same may be said for *Myzorhynchus umbrosus*.

Most of the other mosquitoes are found on the East Coast but are widely distributed and occur inland as well as on the coast. Of these *Culex fatigans*, *Stegomyia scutellaris* the three species of *Mansonia*, the three *Desvoidea*, the two *Taeniorhynchi*, the two Lophoceratomyiæ, *Teromyia quasiferox* the two Uranotæni are examples. *Stegomyia fasciata* occurs in Singapore but only in a few places on the Western coast as at Port Swettenham, Penang, etc.

As regards the mosquitoes themselves some of the species represented have only been occasionally found elsewhere these include *Mansonia annulatus*, *Culex hirsutipalpis ; Desvoidea aurolineata*, *Taeniorhynchus conopas*, *Lophoceratomyia mammilifer*. *Uranotaenia fusca* is a new species but closely allied to *U. inornata*. Certain mosquitoes showed some variation from the type particularly *Cellia Kochii* (*vide* Dr. LEICESTER's description). Of the pitcher plant mosquitoes the Teromyia appears to be a new species but the male resembles *T. funessus*. It is described below as *Teromyia Ater* nov. sp.

The *Colonomyia* is only definitely separated on account of the marked difference in the larvæ and pupa from *C. Caerulocephala*. There are three varieties but the differences, merely of colour, are so slight that it is doubtful if they are distinct species. It is described below as *Colonomyia Mendacis*.

Teromyia Ater.—As seen by the naked eye appears to be almost black in ordinary light with black caudal tufts. When brightly illuminated is metallic colouring seen green on the thorax and purple on the appendages.

Female Head.—Thickly clad with scales black but when brilliantly illuminated green and yellow. Eyes black.

Antennæ.—Basal joint black but covered with white scales. *Clypeus* black. *Proboscis* and *palpi* black but when brilliantly illuminated showing brilliant purple reflections.

Thorax.—Black covered with broad lanceolate scales showing yellow-green reflections. Pleura black with patches of silvery-white scales. Prothoracic lobes covered thickly with white scales. Legs purple-black. Under surface of femora white. Lighter broad bands on tibia and metatarsus of middle legs. Scutellum covered with dark scales with greenish-yellow reflections.

Abdomen.—Dorsal surface dark purple. Venter white scaled. Lateral hairs white. These are longer on the sixth segment and continuous with the caudal tufts of long dark brown hairs on the seventh and eighth segments.

Male.—Antennæ densely plumose. Scales on basal joint scanty black and white Scales on second joint long and narrow and overlapping the base of the third joint. Proboscis black with purple reflections and so are the palpi which are not banded but show a lighter purple patch about the bend. No banding of the legs. Caudal tuft more conspicuous than in the female and arises from the seventh and eighth segment.

Remarks.—The male closely resembles *T. funestus* in its general aspect but differs in that the palpi are much longer and that the last joint of the palpi is nearly twice as long as the penultimate. The antennæ also are longer and the second joint is longer than the third. The basal joint has scales which that of *T. funestus* has not The caudal tufts from the ninth joint is absent in *M. ater*. The female of *T. funestus* is not known and only a single male has been observed.

Occurrence.—Larvæ were found in pitcher plants as *Nepenthes Rafflesiana* on the East Coast Pahang. The caudal flaps of the pupa are rounded but less so than *T. quasiferox*. The respiratory tubes are short and square cut.

Colonemyia Mendacis.—nov. sp.

Head clad with flat scales, white laterally and behind eyes black elsewhere. In certain lights the head appears brilliantly blue. Upright dark brown fork scales posteriorly. Antennæ dark brown; plumose in the male. Palpi four-jointed terminal joint nipple-shaped covered with purple-black imbricated flat scales. Proboscis long black and curved.

Thorax.—Prothoracic lobes prominent bright yellow with yellow hairs and square-ended broad nearly black scales

Mesothorax.—Bright yellow covered with narrow curved scales black in the middle and yellow and black at the sides but different specimens show much variation in the distribution of the yellow and dark scales. The black scales at the sides arranged in small tufts. Basal white transparent scales in pleura.

Wing.—First fork cell longer than second. Vein scales black small square-ended centrally and a few lateral curved narrow scales with square ends. Scutellum distinctly trilobed four brown bristles central lobe and three each lateral one. A patch of broad square-ended brown scales in centre of each lobe much larger in middle lobe.

Legs.—Femora covered with black scales except for the large round patches covered with white scales present in all the members of this genus. Remainder of legs covered with purple-bronze scales slightly lighter in colour at the tarsal joints. Ungues equal not serrate in female. In male abdomen dorsally covered with brown-bronze scales mixed on last segment with bright blue scales. Laterally patches of bright white scales on all segments. Venter yellow covered with golden-yellow scales.

Varieties.—The variation in the thoracic scales has been mentioned but the colour of the thorax of the clypeus and basal joint of the antennæ vary. In a few specimens the mesothorax is almost black except for a yellow edge in front and the scales appear to be golden. In some of these the clypeus and basal joint of antennæ are yellow. In others and also in some specimens with the thorax yellow the clypeus and basal joints of antennæ are ashy-grey.

Occurrence.—Larvæ found in pitcher plants on the East Coast.

Remarks.—The larvæ of *Colonemyia cærulocephala* have a long narrow curved respiratory siphon these mosquitoes have a short broad and straight one. The pupa of *Colonemyia cærulocephala* have long curved thin respiratory tubes with an expanded end. These pupa have short and thick respiratory tubes. It is on account of this marked difference in the larvæ and pupa that the specific distinction rests. The bright yellow clypeus and basal joint of the antennæ are not met with in *C. cærulocephala* but are also not found in those specimens described as varieties. The specimens of *C. mendacis* are larger than those of *C. cærulocephala*.

Notes as to the Pathogenicity of certain Mosquitoes with respect to Filaria Nocturna and Malignant Tertian Malaria.

By G. F. Leicester, M.B., Ch. Edin.

Experiments by direct feeding on patients with Filaria Nocturna and Malaria Parasites of the Malignant and Benign tertian type.

Filaria Nocturna.

With regard to filaria it was found that embryos enter the thoracic muscles of the mosquito and undergo further development in the following mosquitoes (exclusive of *Culex Fatigans* and *Mansonia Uniformis*).

Anophelina:—

Myzorhyncus Sinensis 8 fed 5 infected.
,, *Barbirostus* 5 fed 4 infected.
,, *Peditaeniatus* 1 fed 1 infected.

Culicina:—

Stegomyia Gracilis 8 fed 6 infected.
,, *Perplexa* 3 fed 3 infected.
Scutomyia Albolineata 3 fed 2 infected.
Culex Gelidus 2 fed both infected.
,, *Sitiens* 8 fed 1 infected.
,, *Nigricephala* 1 fed none infected.
,, *Uniformis* 5 fed 5 infected.
Tæniorhyncus Domesticus 1 fed 1 infected.
Mansonia Annulipes 6 fed 6 infected.

The case of filaria was a good one and the same was used throughout. The mosquitoes were kept in test tubes and at the ordinary room temperature here averaging about 85° Fahr. The dissections were made in all cases on mosquitoes about to die and were killed immediately before dissection. The rate of development was very varied in different species but singularly uniform in different members of the same species. The development in *Culex Fatigans* was taken as the standard and the development of the worms was compared with that in *Culex Fatigans* under similar conditions. Development in *Mansonia Annulipes* was remarkably slow and may be said to have been three or four days late, i.e., a mosquito dissected four days after feeding might shew worms no further developed than they would have been in Culex Fatigans at one or two days. On the other hand in *Myzorhyncus Sinensis* the development was more rapid than in any other mosquito dissected not excepting *Culex Fatigans*.

Negative results were obtained with the following :—

Chætomyia Flava 15 fed none infected.

Devoidia :—

D. Obturbans 12 ,, ,,

D. Jugrænsis 4 ,, ,,

Leicesteria :—

L. Dolicocephala 10 ,, ,,

L. Annulitarsis 8 ,, ,,

Stegomyia :—

S. Fusca 10 ,, ,,

Veurallina :—

V. Butelri 3 ,, ,,

Wyeomyia :—

W. Metallicus 4 ,, ,,

These negative results are in my opinion conclusive as the species known or shown to carry are so uniformly infected.

Malaria.

The following species were fed on good Malignant tertian case and were dissected for the most part on the fourth or fifth day after feeding :—

Sub-family Anophelina :—

Genus Myzomyia :—

M. Rossii 2 fed none infected.

Genus Myzorhyncus :—

M. Sinensis 5 ,, ,,

M. Barbirostris 9 ,, ,,

Sub-family Culicina :—

Genus Desvoidea :—

D. Obturbans 5 ,, ,,

Genus Chætomyia :—

C. Flava 8 ,, ,,

Genus Leicesteria :—

L. Delicocephala 7 ,, ,,

L. Longipalpis 4 ,, ,,

L. Annulitarsis 8 ,, ,,

Genus Stegomyia :—

S. Gracilis	8	fed	none infected.
S. Fusca	10	,,	,,
S. Perplexa	4	,,	,,
S. Scutellaris	1	,,	,,

Genus Scutomyia :—

S. Albolineata	3	,,	,,

Genus Culex :—

C. Sitiens	12	,,	,,
C. Gelidus	3	,,	,,
C. Uniformis	6	,,	,,

Genus Mansonia :—

M. Annulipes	15	,,	,,

Sub-family Wyeomyina :—

Genus Wyeomyia :—

W. Metallicus	4	,,	,,

On a case of benign tertian a few mosquitoes were fed, viz :—

Myzorhyncus :—

M. Barbirostris	3	fed	none infected.
M. Sinensis	5	,,	,,

In none of these experiments were mosquitoes re-fed and none lived long enough for the filarial embryos to reach the full stage of development in the mosquito. Of those fed on patients with malaria sufficient time elapsed for development of the zygotes but not enough for the salivary glands to become infected. The mosquitoes were given abundant chances to re-feed both when confined in test tubes and in cages but did not do so. It is possible to keep these mosquitoes alive on fruit but many in which this method was adopted injured themselves either by falling into the water or by getting their wings damaged and these had to be killed at once and dissected.

Only a small proportion of the known species of mosquitoes have so far been tested. These include the common urban species and the hardier jungle species. Sufficient has been done to show the variety in species and genera capable of carrying Filaria and to prove that the urban species even of the anophelina are not good carriers of Malaria.

Many of the species of mosquitoes known in Malaya apparently do not feed on blood and others including such important species as *A. Treacherii*, *Kochii* and *M. leucophyrus* though proved to attack man in their natural condition can not be induced to feed when reared from larvæ or in captivity.

PART IV.

The Outbreaks of Rinderpest in Selangor in 1903 and 1904.

No addition has been made to the knowledge of the causation of Rinderpest or of the organism producing it, but the course of the outbreaks, the conditions under which it spreads and the relative susceptibilities of various breeds of animals are points of interest.

I have confined my accounts to those of the outbreaks in Selangor as these I was able to follow. From the information placed at my disposal as regarding outbreaks elsewhere I conclude that in the main the conditions were similar and the main conclusions I draw are essentially similar to those on which previous action by the Government Veterinary Surgeons, Messrs. Moir and Ford, has been based in the past.

Epidemics have been numerous and destructive in the past, and for some time a doubt had been entertained by some as to whether the disease was Rinderpest or Hæmorrhagic Septicæmia. This doubt was sufficient to discourage attempts at serum treatment in any form. A series of attempts to locally prepare a serum did not give sufficiently satisfactory results to be conclusive to others of its value or to render its adoption general.

It is necessary before considering the disease to mention the main breeds of cattle in the Peninsula, but crosses are common. There are five main breeds, Siamese, Indian and Bali bullocks and Malay and Indian buffaloes.

1. Siamese cattle are small sturdy beasts standing about 12 hands and weighing about 500 lbs. The horns are short and slightly curved so as to point upwards and forwards. They diverge widely. In colour they are yellow or brown, and a smaller variety, Kedah cattle, are black. They are rarely if ever white. The skin and hair in texture resemble that of English breeds.

2. Indian cattle are larger animals standing sometimes up to 14 hands and weighing up to 700 lbs. The horns are long and curve backwards or forwards. They diverge little. They are frequently white, but may be dark brown, or mottled, and are rarely yellow. They usually show some indication of a hump.

These breeds cross freely.

3. The Bali bullock has not been imported into the country except for beef. The original breed is not known, but it has been crossed with the Borneo Sladang, *Bos sundinacus*, and shows the markings and has the shape of that animal.

4. The Malay buffalo, Cariboo (Malay Kerbau), is a water buffalo and stands some 13 hands and weighs up to 1,000 lbs. They are powerful beasts and used for heavy and jungle work by the Malays chiefly. The horns are long, slightly curved upwards, and project from each side of the head laterally. For two-thirds of their length they are ridged transversely. With the heads extended, as when charging, the horns and upper part of the neck are nearly in the same plane. They are usually a dirty black colour with a sparse covering of coarse hair. They may, however, be white.

5. The Indian water buffalo is a different shaped animal, and is easily recognised by the twisted and curled horn which usually curves irregularly backwards. They are imported mainly for milk, and are the breed known in India as Delhi buffaloes.

These distinctions of breed are of great importance as the susceptibility differs greatly and the course of the disease differs according to breed. Some breeds, such as the Malay buffalo, suffer most severely, others, as the bullocks, are the active agents in spreading the disease though they do not suffer so severely.

The Malay buffalo is by far the most susceptible and the Indian buffalo the least. In an epidemic in any group all or nearly all the Malay buffaloes are attacked and only the calves and a few adults of the Indian buffaloes.

The mortality is greatest amongst the Malay buffaloes; 85 per cent. case mortality for these is low. Amongst the Siamese cattle there is considerable variation, but on the average about half the cases recover and a rather larger proportion of the better class of Indian cattle. About 25 per cent. of the Indian buffalo calves die, but few of the full grown buffaloes.

The Bali bullocks are susceptible and all attacked have died, but the numbers observed are too small for comparative purposes.

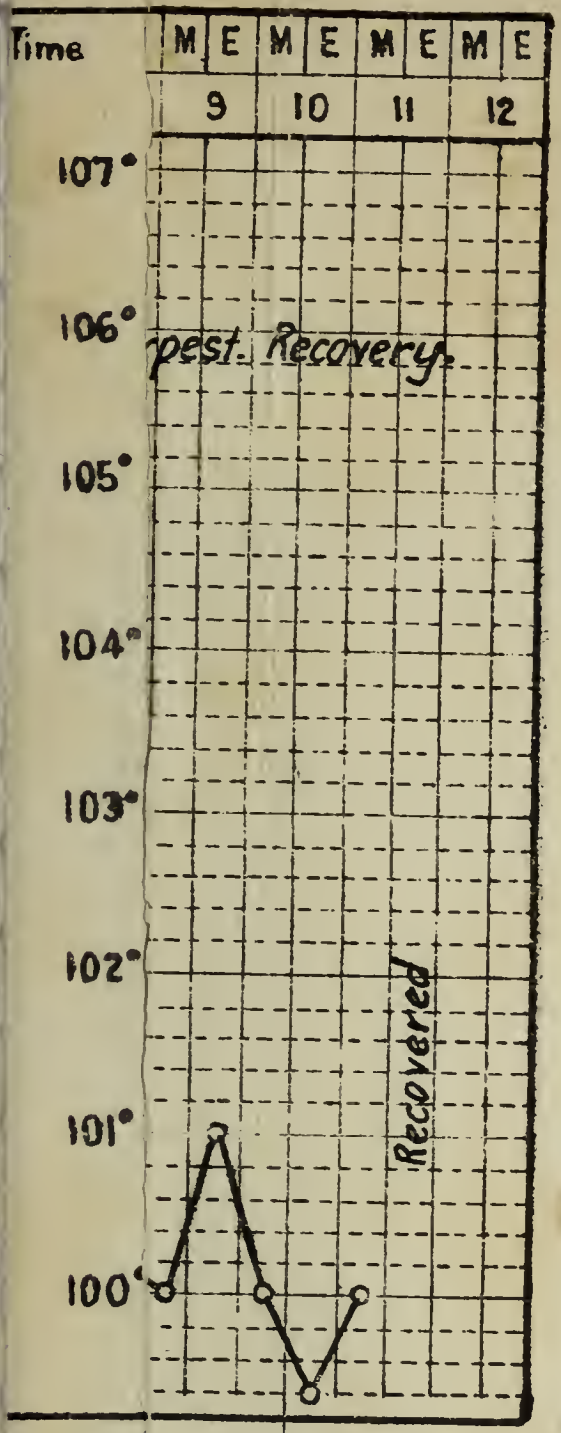
The Course of the Disease.—As this varies greatly it is simpler to describe first the severe form, that seen in Malay buffaloes, in detail, and then consider the differences in the other breeds of cattle.

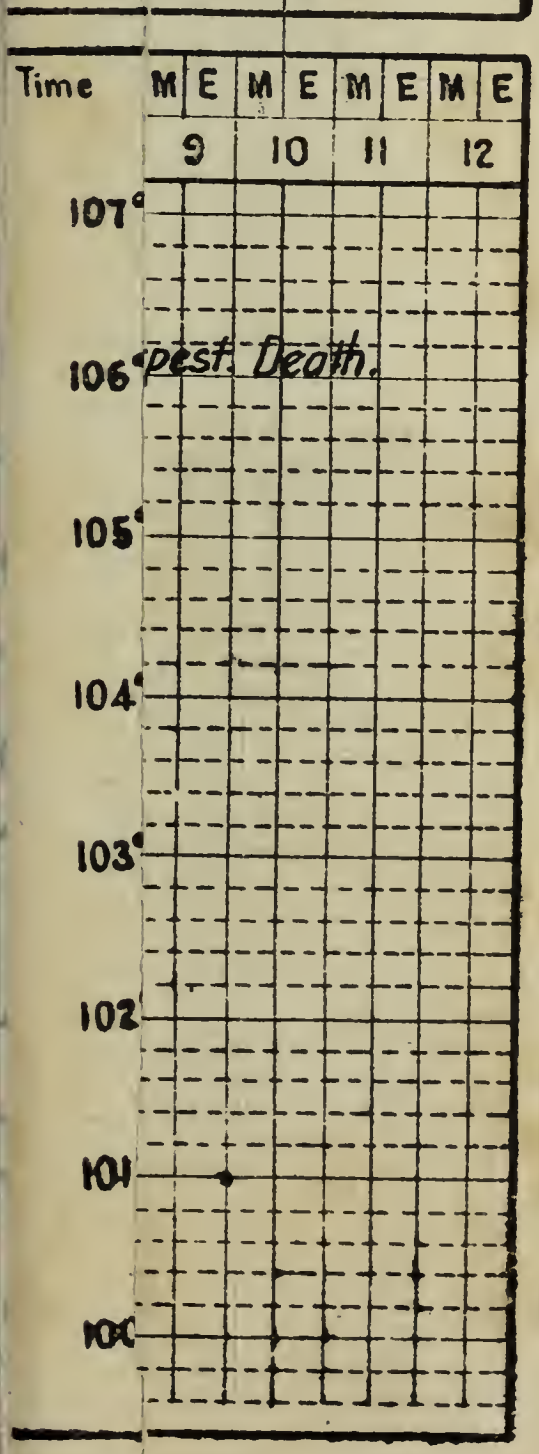
Period of Incubation.—This is well known to be from inoculation a period 3 to 4 days. Infection in a natural manner is more difficult to ascertain, but appears to be less regular. The actual date of onset as determined by onset of characteristic symptoms is often not definite, but, though only shown at first by a rise of temperature, is really sudden.

From several series in which the temperature of all animals was taken daily the period of incubation appears to be usually 4 to 6 days but may be as long as 8. In buffaloes 5 days seems to be the common period. It is highly exceptional for the first attack as indicated by the rise of temperature to occur amongst a group of contacts 7 days after removal from the source of infection. The animal may not appear to be ill for two or more days after this and may even be able to work for 4 days or more, and in such cases, as the early stages are overlooked, the period of incubation will appear to be longer. This is more often the case with bullocks. The buffalo usually is obviously ill 24 to 36 hours after the onset of the disease.

During the period of incubation the animal appears to be in perfect health.

Onset in the Malay Buffalo.—As tested by the thermometer the onset of the disease is sudden. An animal whose temperature has previously been normal is found to have a temperature over 103 or 104 or even over 105° F. At this stage there may be absolutely no other sign of illness, but more frequently there is some exaggeration of the usual congestion of the conjunctiva, and if motions are passed they will be harder than normal. The animal will still feed and ruminate in a natural manner and does not seem more depressed than a quiescent buffalo usually is. In this early stage even an expert veterinary surgeon used to this buffalo and on the look out for fresh cases may easily overlook such early cases. Symptoms rapidly


Time
M E M E M E M E
9 10 11 12
107°
106°
pest. Recovery.
105°
104°
103°
102°
101°
100°
Recovered


Time
M E M E M E M E
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107°
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pest. Death.
105°
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103°
102°
101°
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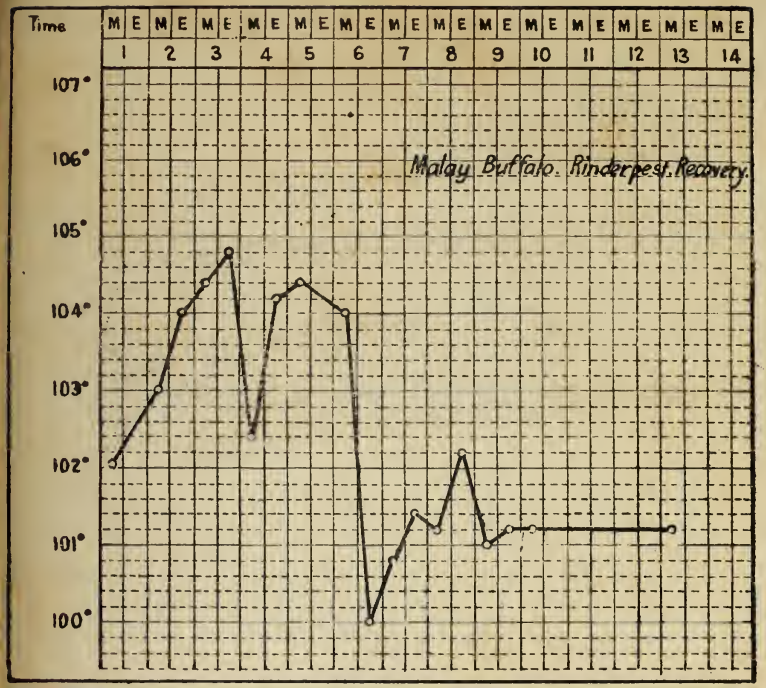
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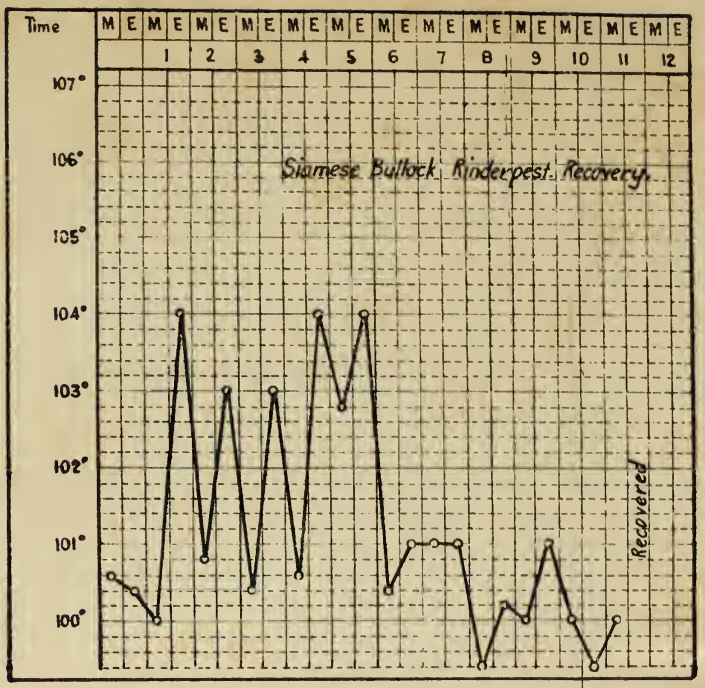
Malay Buffalo. Rinderpest. Recovery.


Time
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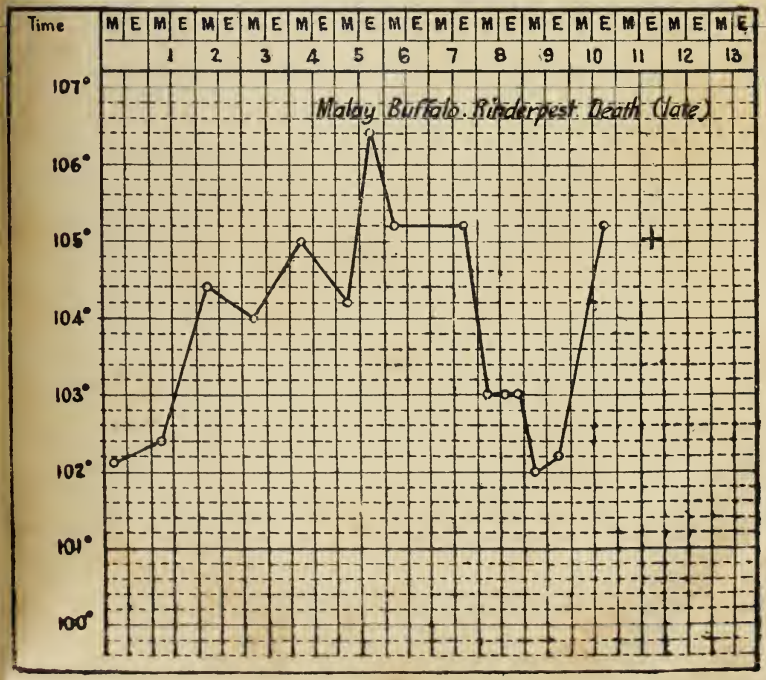
Siamese Bullock. Rinderpest. Recovery.
Recovered


Time
M E M E M E M E M E M E M E M E M E M E M E M E M E
1 2 3 4 5 6 7 8 9 10 11 12 13
107°
106°
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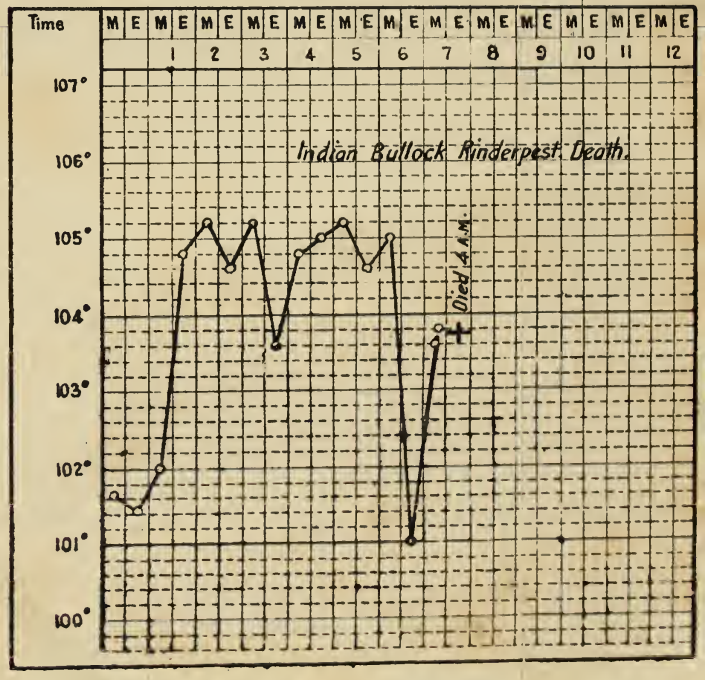
103°
102°
101°
100°
Malay Buffalo. Rinderpest. Death (late)


Time
M E M E M E M E M E M E M E M E M E M E M E M E M E
1 2 3 4 5 6 7 8 9 10 11 12
107°
106°
105°
104°
103°
102°
101°
100°
Indian Bullock. Rinderpest. Death.
Died 4 A.M.

supervene, mainly manifestations of gastro-intestinal disease and affections of the visible mucous surfaces. The conjuctiva becomes intensely congested and there is a free watery discharge, which becomes thicker and by the third or fourth day is muco-purulent. There is discharge from the mouth and nose also at first watery but becoming thicker and more muco-purulent, and the mucous membranes of the mouth and nose are congested. On the inner aspect of the lips and especially towards the canthi there are often patches of adherent granular material. On the forcible removal of this layer by rubbing it the mucous membrane beneath is seen to be markedly congested and sometimes excoriated or superficially ulcerated.

The temperature is maintained usually over 104, and there is little or no morning remission.

The animal may feed for the first 24 hours, but the amount of food taken is below the average. After the second day little or no food will be taken and only occasionally will the animal ruminate and then only for brief periods. There is excessive thirst. The animal is obviously depressed and stands with drooping head taking little notice of surroundings. Occasionally the animal may become violently maniacal.

The early stage of constipation rarely lasts for more than 24 hours, and usually some 36 hours after the first rise of temperature diarrhœa sets in and rapidly becomes profuse. The motions are offensive. At first they are loose and watery, but soon are mixed with mucus and mixed or streaked with blood, and may contain flakes or shreds of mucous membrane. In character as the disease advances the motions are more and more dysenteric and are passed with much straining and tenesmus, and often the animal shows obvious signs of abdominal pain.

Death may occur on the fourth day of the disease and is said to occur even on the second or third, but is most usual on the fifth or sixth. The temperature a few hours before death rapidly falls and often becomes subnormal.

The great majority, in some outbreaks practically all, die, but if death does not occur before the eighth day the prognosis becomes much more favourable though deaths do occur amongst animals apparently convalescent up to at least 14 days after the onset of the illness.

In illustration of the extreme susceptibility and the virulence of the disease in Malay buffaloes are the epidemics at Dusun Tua, where 7 animals out of 9 were attacked and all died. At Port Swettenham in the Quarantine Station 24 were attacked and 21 died, or 86 per cent. There were 6 other buffaloes in the shed but these were killed at the rate of two daily for beef before they had time to acquire the disease so that the proportion attacked cannot be definitely ascertained. In the Selangor outbreak the only Malay buffaloes, 8, known to have been in contact with infected bullocks acquired the disease and all died.

Morbid Anatomy.—In addition to the lesions observable during life the post-mortem examination shows extensive implication of the gastro-intestinal tract. In the abdomen there was excess of clear fluid in the peritoneal cavity and usually some recent formation of fibrous lymph. The changes never amounted to acute peritonitis. The mesenteric glands were enlarged and in some cases there were hæmorrhages in them. The pharynx and œsophagus were usually congested. There were no definite lesions in the first three stomachs, but the fourth, the abomasum, was invariably the seat of severe lesions. It was always intensely congested

and showed submucous hæmorrhages varying in size and number in different cases. In some of these cases there was destruction of the mucous membrane over part of the larger of these hæmorrhagic areas forming ulcers, and in other cases there was micro or macroscopic evidence of necrosis. In a few cases there was definite ulceration independently of the hæmorrhagic areas. The vessels leading from these ulcers were in some cases filled with antemortem thrombus.

The duodenum was acutely congested, and the changes in some cases were as acute as in the abomasum and then there was also ulceration.

The small intestines in a slighter degree were more or less congested, but ulceration in any part but the duodenum was highly exceptional. Peyer's patches were not markedly enlarged and in no cases were they ulcerated.

The cæcum and large intestine were preferential sites for acute lesions. The whole course from the Cæcum to the Rectum was congested, and patechiæ and ecchymoses occurred in some cases down the whole extent. These ecchymoses are usually arranged longitudinally down the bowel. The changes were most marked in the majority of cases in the cæcum and rectum. Actual ulceration of the cæcum was not common but in the rectum was present in nearly all cases, and the lesions were marked, extensive, and sometimes deep.

The liver, beyond congestion and cloudy swelling, showed no changes where death occurred in the earlier stages of the disease, but in cases where death occurred later fatty degeneration was found. The gall-bladder was usually distended with bile but in some cases hæmorrhage had taken place into the cavity and in all acute cases the mucous membrane was injected, much congested, and patechiæ or submucous hæmorrhages were present. The changes were not unlike those met with in the abomasum, but ulceration was only seen in two cases.

The spleen was not enlarged. The kidneys were much congested.

The trachea was usually injected and some congestion of the lungs present with extensive emphysematous areas. Subpleural ecchymoses were not uncommon but were rarely extensive or numerous. Definite consolidation of large areas, acute lobar pneumonia, was found in some cases but in so small a proportion that it must be considered as a complication not as part of the disease.

The heart muscles were friable and small patechiæ were sometimes found under either parietal or visceral pericardium and under the endocardium. No subcutaneous or intramuscular hæmorrhages were found, and no signs of suppuration or localised swellings either in the tissues of the neck or elsewhere.

The above description applies only to the Malay buffalo, and it applies equally to cases in which the infection was derived from bullocks and from other Malay buffaloes.

In Siamese and Indian cattle the disease runs a milder course and in fatal cases the lesions are less severe. So great is the difference that, except for the communicability of the disease from cattle to buffaloes and vice versa, doubt might be entertained as to the identity of the disease.

The period of incubation is much the same but early cases are very rare and 6 or 7 days is the more usual period. The duration is less certain than in the Malay buffalo for the sudden rise of temperature marking the onset though usual is not always present, and the marked symptoms are often delayed in their appearance to the fourth or fifth day after the onset of the disease.

The differences in the course of the disease in addition to the slower appearance of symptoms, the later period of deaths and the smaller mortality, are that the conjunctival congestion and the discharges from the conjunctiva mouth and nose are much less. They may be scanty or even absent. Diarrhœa does not often set in till the third day and in some cases may not occur to a marked extent at all. The diarrhœa does not so rapidly become dysenteric and may not become so at all or may only remain so for one or two days. The animal frequently, even in a fatal case, will feed and ruminate till the fourth day.

The course of the disease as shown by the temperature in most cases is fairly regular. There is a sudden rise of temperature perhaps to 104 or over, and the temperature remains high, but usually with some morning intermission, for 6 days, when it falls rapidly, and in cases of recovery though it may be irregular for a few days there is a rapid improvement in the condition of the animal which in the course of a day or two will begin to feed, to pass firmer motions, and to resume its normal aspect.

In an unfavourable case the temperature after about the same period, 6 to 7 days, may fall to subnormal and the animal die collapsed, or may remain high or even become higher and the animal die within 24 hours. In other cases though the temperature falls in a natural manner and does not rise much again the symptoms are only partly relieved, the animal will not feed, and dies in 3 or 4 days.

The course in Siamese and Indian cattles is much the same but the mortality is greater in the Siamese. In the Selangor outbreaks Mr. Ford's figures show that there were amongst 90 Siamese cattle 68 deaths, or 75 per cent. mortality; amongst Indian cattle 90 cases with 48 deaths, or 53 per cent. mortality; amongst mixed breeds there were 10 cases with 6 deaths.

On the whole there is more variety in the severity of the disease in the Siamese cattle. These cattle are cheap and can be brought to Kwala Lumpur for some $50 to $60 per head. The Chinese usually feed them well and do not overwork them. The mortality amongst the Chinese owned Siamese cattle was 66 per cent. The Malays and Tamils and Pathans more often neglect and overwork their cattle, and cattle belonging to Europeans are sometimes left entirely in the hands of such employees. Amongst such groups of cattle the mortality was greater. For these figures I am indebted to Mr. Ford.

One complication is the large proportion of cattle that harbour the *Pirosoma bigeminum*. When the cattle are in good health these parasites are only found after a prolonged search, and as none of the Siamese or Indian cattle ever show the ordinary symptoms of Texas Fever (Bovine Malaria) though freely exposed to infection, it is fair to assume that all are ordinarily immune to the effects of the parasites, and that probably nearly all harbour a small number of the parasites. Be this as it may in animals after an attack of Rinderpest these pirosoma are found in much larger numbers and often in much reduced cattle in such large numbers that it is difficult to avoid the conclusion that their multiplication occurring at the end of a serious illness such as Rinderpest is injurious and in part the cause of some of the fatal results.

Post-mortem appearances in fatal cases of Rinderpest in cattle are slight as compared with those in the buffalo. In a fairly typical case all that may be found is congestion of the abomasum duodenum cæcum and rectum with small submucous hæmorrhages in one or more of these places. Ulceration

is exceptional but does occur. The gall-bladder is not affected. The trachea and œsophagus may or may not be injected. Some enlargement of the mesenteric glands is common. In cases where death occurs late, say 9 to 10 days, fatty degeneration of the liver may be found.

The course of the disease in the Bali bullocks resembles that in the Malay buffalo, but the animal is excited rather than depressed. The post-mortem lesions are less marked.

Indian Buffalo.—Though large numbers of Indian buffaloes, about 400, were present in infected districts and even in contact with infected bullocks only 15 adults in all were attacked during the epidemic, and of these all but one recovered though for the first 3 days the symptoms of disease do not differ much from those observed in the other cattle. After this the disease seemed to abort and the animals rapidly recovered. Of some 10 Malay buffaloes in the same district 4 were attacked and all died.

Calves, however, do not show the same degree of immunity and a larger number, 25, were known to be attacked.

An outbreak also occurred in the quarantine shed at Port Swettenham amongst a cargo of 24 Indian buffalo calves, and all were attacked. The mortality was not high, out of the 25 attacked in the Selangor outbreak 12 died, or 48 per cent. and at Port Swettenham 4 died, or 16.6 per cent.

The post-mortem appearances showed changes similar to those in the cattle.

Skin lesions are by some considered to be of diagnostic importance. The discharges from the eyes and rectum frequently cause excoriation. The skin and hair lose their gloss and the coat "stares." A papular eruption is not uncommon but also occurs in healthy cattle.

A herpetic eruption in the mouth is described. Personally I have not seen this, but occasionally the excoriation beneath the branny exudation on the inner aspect of the lips is arranged in points which may be remnants of ruptured vesicles.

In buffaloes there is often an intensification of the redness natural on the inner aspect of the thighs and near the genitalia. This redness is not only more intense but deeper in colour, and in the last stages exudations may occur. The natives, I find, attach great importance to this change in colour for diagnostic purposes, and so do some Europeans of experience. I did not consider the change which does occur to be sufficiently marked to be of much value.

As regards the diagnosis of the disease in isolated cases or at the commencement of an outbreak this may be difficult. In many of its clinical aspects there is a suspiciously close resemblance to some of the outbreaks described as *Hæmorrhagic Septicæmia*, and as the local swellings which are a feature of that disease may not be present the absence of such swellings is no proof that the disease is not *Hæmorrhagic Septicæmia*.

In *Hæmorrhagic Septicæmia*, however, a characteristic organism is found in the blood, glands, etc. In the outbreaks here considered numerous animals either killed in various stages of the disease or immediately after natural death from the disease were examined. In none of these were these organisms found in any of the tissues or fluids of the body, and inoculation of various media with these fluids, with scrapings from the glands, liver, spleen, etc., were barren, with the exception of a rare contamination from skin or air organisms.

Moreover certain animals, rabbits and guinea pigs, are highly susceptible to Hæmorrhagic Septicæmia and immune to Rinderpest. The blood and scrapings from the glands of cattle with the disease were injected either subcutaneously or intraperitoneally into 12 rabbits and 14 guinea pigs, and in no case were these animals infected.

In cases where the cattle or buffaloes had been dead for some hours the results of injection were uncertain and some of the injected animals died, but even in these cases the organisms found in the tissues and fluids of the dead rabbits or guinea pigs were not those of *Hæmorrhagic Septicæmia*, and the organisms obtained in such cases from the blood or serum of the cattle varied in different cases and could usually be identified as organisms commonly met with in the early stages of putrefaction. The organisms recovered from the blood or tissues of the animals in no case were those of *Hæmorrhagic Septicæmia*.

The outbreaks at Port Swettenham and Kwala Lumpur were the ones investigated bacteriologically, and the negative evidence against the disease being *Hæmorrhagic Septicæmia* was conclusive.

At Dusan Tua the buffaloes had been dead for some hours, and though the injection of blood was fatal to the smaller rodents and organisms were obtained by culture from the blood of these animals the organisms isolated either from the direct cultures or after passing through the small rodents were not those of *Hæmorrhagic Septicæmia*.

All attempts at finding any organism, animal or vegetable, bacterial or protozoal, to which the causation of the disease could be assigned have failed. The frequent presence of Pirosoma in cattle and in one buffalo only of a trypansome were merely examples of concurrent diseases.

The course of the outbreaks and the manner in which the disease spreads is of great practical importance, as on the knowledge of such factors measures for the prevention must be based.

It may be stated at the outset that though there is evidence that wild pig and some domesticated pigs get the disease and that it is probable that other game, particularly the Sladang, may do so. No part seems to have been played by these animals in the spread of the Selangor outbreaks. No spread could be traced to goats and no cases occurred amongst the goats, nor was I successful in artificially by inoculation transmitting the disease to goats. I am aware that in some outbreaks of Rinderpest some breeds of goats have been proved to be susceptible.

For all practical purposes in Selangor the disease can be considered as one transmitted from Cattle or Buffaloes to Buffaloes or Cattle directly or through the medium of fairly fresh discharges from diseased animals.

The disease is not endemic and districts may remain for years free from the disease. When imported, however, it rapidly spreads unless active measures are taken to prevent the spread of infection. Though not endemic it is rare to find all parts of the Malay Peninsula free from the disease at any one time, and cattle are also imported from India, Siam, and the Malay Archipelago, and kept for a variable period at Singapore or Penang. Through these Cattle the disease is, from time to time, re-introduced. In Selangor in the period under review there were five definite importations of the disease.

Two of these were detected and stopped at Port Swettenham, viz., one amongst Malay buffaloes in November, 1903, and one amongst Indian buffalo calves in June, 1904. Two other importations were unfortunately not detected at Port Swettenham but were seen amongst the recently

imported cattle at Kwala Selangor and Kwala Lumpur respectively, and to these two importations the two epidemics, the outbreaks at Kwala Selangor, Kwala Lumpur, and their environs, were directly referable.

The other outbreak, August, 1903, occurred in various small stations along the Seremban Road, the main road from Negri Sembilan to Kwala Lumpur, and was probably due to the importation of mildly diseased cattle viâ the unprotected port of Negri Sembilan, Port Dickson.

Each time the disease was discovered at Port Swettenham the cases were detained at the Quarantine Station, and though it spread to other animals in that station there was no extension of the disease outside.

On the two occasions in which the disease was not detected at Port Swettenham it spread more widely, and cattle and buffaloes long resident in or native to the country were in time attacked. Owing to the energetic measures adopted by the Government Veterinary Surgeon, though the loss was heavy, the epidemics were localised and did not involve any extensive area.

The outbreak along the Seremban road was fortunately through a country where cattle and buffaloes were not numerous. There were three separate places infected when the outbreak was discovered at the 8th, 12th and 21st miles respectively. The roads were closed, the cattle isolated and some of the diseased shot and this epidemic was soon stamped out with a loss of 7 buffaloes and 7 bullocks.

It will be seen from the detailed account of some of the outbreaks not only that the disease is imported but that the local spread from any focus is due to direct spread by cattle and to causes preventible in the sense that human care and intelligence with moderate expenditure of money can prevent them.

It is not pandemic, nor widely diffused in earth, air or water. Each case can be traced to a preceding case and a probable means of transfer pointed out and often proved.

History of the first Port Swettenham Outbreak.—A cargo of 30 Siamese buffaloes arrived at Port Swettenham on November 6th, 1903, by S.S. "*Pulau Rimau*." The buffaloes had been for 20 days at Province Wellesley. They were placed in the quarantine sheds and one died on November 10th. On the 11th two were found to be suffering from Rinderpest and were shot. On the 13th, 15th, 16th and 17th, there were respectively 4, 1, 6 and 3 cases, and the remainder were attacked by the 19th.

Others who had not shown any sign of disease had been killed for meat before this date.

In the Quarantine Station there were in other sheds 30 Siamese bullocks. None of these were attacked till November 22nd, 12 days after the first death and probably 16 days after the first infection of the station, a period to be noted as more than twice the period of incubation for these animals for this disease and, therefore, indicating that during at least half this period, over a week, there was no spread of infection to animals in adjoining sheds some 30 feet away from the shed in which the infected buffaloes were kept.

Between 22nd and 24th of November all these bullocks were attacked, proving a common source of infection between November 16th and 19th. The probable source of this general infection was not difficult to trace as during this period there were high tides and a faulty self-acting valve allowed the water in the drains to be backed up into the station and so

flooded the entire station. As these drains received the washings of the infected shed and much of the excreta of the diseased buffaloes the conditions necessary for the general infection which occurred were present.

The possibility of the disease having been conveyed by the attendants, buckets, etc., exists, but would not probably have caused so sudden and general a diffusion of the infection.

Kwala Selangor Outbreak.—I had no opportunity of inspecting this outbreak, but Mr. FORD informs me that the first death was on or about January 10th to 12th, and the second 12th to 14th, amongst a shipment of eleven Indian calves which left Penang on January 2nd. As the existence of Rinderpest in Penang had not been notified they were not placed in quarantine at Port Swettenham, but marched direct overland, a journey of 2 to 3 days. As will be seen from the dates of death the two first cases must then have been in the period of incubation. If they had been quarantined for the usual period of 10 days as they would have been if information of the outbreak in Penang had been given the disease in this severe form could hardly have been overlooked even with the imperfect supervision then exercised.

That the infection took place at Penang, not on board ship, is probable, as 18 buffaloes imported at the same time in the same boat were not infected.

A few days after this second death a local bullock died and after this the disease occurred amongst other local animals as well as amongst 3 other of the imported calves. In all there were 47 deaths before the epidemic was stamped out, and 23 of these were calves.

Cases occurred not only at the original focus where the imported calves were attacked but at two stations along the road 2 and $3\frac{1}{2}$ miles respectively from this place.

To both of these places the transfer of cattle between the period from the outbreak of the disease, about January 6th, to its notification on February 8th, were definitely traced.

The Kwala Lumpur outbreak occurred immediately after the Kwala Selangor one, but was only related to it in that it was also introduced by a cargo of Indian bullocks from Penang, then known as a result of enquiries made in connection with the Kwala Selangor outbreak to be an infected port. These 15 cattle left Penang by S.S. "*Pulau Rimau*" and arrived at Port Swettenham on February 3rd. They were detained at the Quarantine Station till February 13th, and were inspected at Kwala Lumpur on February 15th by the Veterinary Inspector. There were no deaths at the Quarantine Station and no illness was reported, but as there was at that time no skilled supervision at the Quarantine Station a mild attack might easily have escaped notice. On February 21st at Kwala Lumpur one of these animals died and the owner next day reported the death. On examining the animals on the 22nd, one was definitely suffering from Rinderpest, but in the late stage, say sixth or seventh day, just after the temperature has fallen but with some of the symptoms still marked. Two other animals of the same batch presented symptoms of the mild form of the disease at about the same period. These three animals rapidly recovered, but though subsequently freely exposed to infection none of them developed the disease, thus confirming the preliminary diagnosis. As the usual period of death in Indian bullocks is the sixth or seventh day, as the other three animals were in the stage that is usual in mild attacks about the seventh day, it is probable that the onset in all four cases was on or about the 15th of February, and as

temperatures were not taken, there would be nothing at the inspection on that date to show that the animals were ill even if at the time of inspection the disease had commenced. It is to be noted that during the period from February 15th to February 22nd during which these animals sickened there was nothing to prevent the spread of infection and the wide distribution of animals in contact with these diseased ones. Later proof was obtained that some animals from the shed had been sold and taken to a place where they developed the disease and acted as foci for other outbreaks.

The three living animals with the disease were immediately isolated, and the remaining eleven of the imported cattle were also isolated and another group of 22, which were in stalls sufficiently close for the possibility of infection to have occurred, separately isolated, and all movements in and out of an area of about two square miles were prohibited. The cattle in this area, numbering some 250, were inspected daily and kept tied up. No further cases occurred amongst the cattle except amongst those which had formed a part of the first shipment. Amongst these 2 cases occurred on the 25th. The remaining 10 of this group which were free from any sign of the disease were taken to the Institute and kept in the veterinary enclosure. One case amongst these occurred on the 28th, one on March 1st, and one each on the 11th and 13th. Some attempt at isolation was made in that as soon as any animal was attacked it was kept separate, but the space available was not sufficient for complete isolation. Even the imperfect attempt was partly successful as 6 were not attacked and 2 of them were proved to be susceptible as they subsequently acquired the disease in a later outbreak.

It appeared, therefore, that the epidemic had been stamped out in a cattle district by simple means and with a loss of only 4 head out of 10 attacked.

After the attack had been recognised, except amongst the original herd, there were no fresh cases in that district for some months, and this herd was so isolated that no spread to other cattle took place.

In spite of this two fresh outbreak, about 3 and 5 miles respectively from the site of the original outbreaks, were discovered on February 27th and March 15th respectively. Subsequently it was ascertained that cattle from the originally infected area had been sent to these places just before that outbreak had been reported but during the period when the original four animals were suffering from the disease. Two fresh foci were thus formed. At both these places the ground is irregular and full of holes from old tin mines and brickfields. The cattle sheds were built on the elevated portions and in the hollows between the animals grazed and were washed and the drainage from the sheds naturally passed into these hollows.

Proper isolation in this district was impossible. The cattle showing no signs of the disease were removed to temporary quarantine stations and inoculated with Indian Rinderpest Serum.

In one of these two outbreaks when reported, February 27th, one animal was found dead and one was attacked in the next week. There had been a death, cause unknown, February 21th.

The second outbreak was reported on March 15th, and four animals were then suffering from Rinderpest, and by the 17th, four more were down with the disease.

From these localities, during the period before they were discovered, cattle were moved and fresh foci established, and for some months fresh outbreaks were discovered almost every week. The natives, particularly those from India, did not report cases at all or until a death had occurred, and in some cases outbreaks were only detected by the discovery of a freshly buried animal, anonymous letters, etc.

In nearly all isolated outbreaks the origin of the disease could be traced to the movement of cattle from an infected place previous to the discovery of that infection.

One series of outbreaks was directly referable to cattle being allowed to graze on land on which infected cattle were or had been grazing. A large number of bullock carts were required in connection with the railway workshop at Batu Road 3rd mile. Near this place was an early infected district, and, in spite of strict orders to the contrary, when carts were unloaded bullocks were often allowed to graze freely on this ground, and amongst groups of these cattle the disease occurred.

The furthest places from Kwala Lumpur to which the disease spread were Cheras, 10th mile, Dusun Tua, 17 mile, and Kuchai, 15th mile. In these places comparatively early information of the outbreaks was received, and the disease remained limited to the group of animals amongst which it originated. The infection in two cases could be traced to the movement of one or more cattle from an infected area in Kwala Lumpur.

It was satisfactory to find at Dusun Tua that the inhabitants themselves discovered the outbreak and its source, gave the necessary information and had rigidly confined their own cattle on their own responsibility. No further spread of the disease took place from these centres.

As a general result each of the numerous outbreaks were, as outbreaks, quickly suppressed, but in the majority of cases sufficiently early information was not obtained and infected cattle in the incubation stage had been moved elsewhere and so started fresh outbreaks. Little help can be obtained from the Indian natives, and information as to these transfers was only obtained after the fresh outbreaks. The people concerned in the transfer invariably deny that any cattle have been transferred, and the proof that they have is only to be obtained indirectly subsequently. The great majority of the cases, 209 out of 245, in which the ownership was noted were in cattle belonging to natives of India.

All the evidence points to a comparatively short diffusion of the virus in air under the ordinary conditions. There were cattle grazing within 40 yards of the veterinary reserve at the Institute where cattle with Rinderpest were confined. None of these acquired the disease. A few cattle confined for over a month in and near a shed within this reserve did not acquire the disease, though other cattle in a shed 25 yards off were, during that period, in the acute stages of the disease. Not only as already mentioned in the outbreak at the quarantine station did infection not take place for over a week from a shed some 30 feet distant, but even of the buffaloes in the same long shed more than one-third did not get the disease for over two weeks, showing that no infection had been acquired by them for at least one week. It is also noteworthy that of animals confined in the same shed that if isolated from each other a considerable proportion escape infection and those that become infected are often the pairs that work together. Out of one batch of 20, two pairs escaped infection altogether, and only one other animal, whilst of the remaining 15, in 4 pairs both animals were attacked on the

same day, and in 3 other pairs there was an interval of 5 or 6 days between the onset of the attack in the two animals, i.e., one had infected the other. Considering the opportunities in a cattle shed for fouling of beds and fodder and the dissemination, when the sheds are flushed, of discharges from a diseased animal, it is open to question whether the disease is conveyed at all through the air or whether it is not always conveyed by the infective discharges.

A good deal of the confusion that arises in the comparison of the effects of serum inoculation, etc., is due to differences of opinion as to what constitutes effective "contact."

Theoretically "contacts" are animals which have been exposed to infection, but experience shows that even of a herd where the exposure to the possibility of infection has been considerable only a few animals are infected, though these may subsequently infect the entire herd, and in other instances where apparently there has been exposure to infection of susceptible animals none of them are attacked.

In considering the value of serum, as we know that it has no effect in preventing the occurrence of disease in animals already infected, I take as the test of effective contact the occurrence of cases of Rinderpest in a herd within 10 days of injection, i.e., 7 days for incubation and 3 days for the obvious symptoms to become apparent. Where routine temperatures are taken I should shorten this period to 8 days.

It is known that all the discharges of a diseased animal are capable of carrying the disease and that the virus is not retained in the discharges or blood of the animal for long. The question of the length of time that a shed or pasture will remain infected is of practical importance. Experiments with the virus, *in vitrio*, are not conclusive, as the natural conditions differ. Though no direct experiments were made it was considered better, in cases of certain groups of cattle doubtfully contacts, to send them to the Institute in preference to sending them to the quarantine station where infection was almost certain. No cases developed amongst these groups, though in one case the cattle were grazing over the same ground and occupying the same sheds that had been used for cattle with Rinderpest a month previously, so that even under natural conditions it appears that in this country the virus is destroyed in less than one month.

On theoretical grounds it is certain that the disease can be conveyed by man directly conveying on his clothes, person or utensils, in fodder or in bedding, the discharges of a diseased animal to a healthy one. I believe from what I have seen of the carelessness of natives that the disease is often conveyed in this manner from one animal to another of the same herd. Even in taking temperatures there is difficulty in preventing this mode of infection. Although for short distances this is probably a fertile source of infection there was no instance in these outbreaks in which it appeared probable that the disease had been carried by man to any considerable distance, or that any other cause but the transfer of cattle was the origin of any outbreak.

Mr. Ford informs me, however, that in a previous epidemic a Malay cattle witch, *bomor*, after charming a diseased herd conveyed the infection about 3½ miles to her own herd. In that case there had certainly been no transfer of cattle.

The class of animals dangerous as carriers of the disease is important. We know that mild attacks are fertile sources of infection, the more so that

attacks may be so mild that the animal may only appear to be in ill health for a day or two and may be able to travel and even to work throughout the illness. These animals, usually Indian bullocks, are the most dangerous carriers, more so than the Malay buffalo which is usually unfit to travel before the discharges are abundant. These animals show little disposition to travel and are so markedly ill that the disease is at once detected.

Indian Buffalo calves were possibly carriers amongst the adjoining herds of cattle at the 2nd mile Batu Road.

We have no proof how long convalescents can carry infection. No case of infection could be traced to any of the convalescents discharged. Careful watch was maintained. Only few convalescents were allowed out of isolation in three weeks, and the majority were kept over a month, often much more than a month, so that a convalescent does not convey the disease more than three weeks after convalescence.

Prophylactic use of Serum.—Inoculation with serum prepared locally and inoculation combined with simultaneous injection of virulent blood had been tried in previous epidemics. The results had not been sufficiently conclusive to cause the general adoption of either method.

There are considerable difficulties in the local preparation of serum, and considering the high price of cattle and the expense of a staff for serum work it was considered cheaper and better to import serum from India.

Mr. Moir, the Government Veterinary Surgeon, Perak, had been using this serum for some time and considered his results as highly satisfactory.

Mr. Ford, the Government Veterinary Surgeon, Selangor, first used this serum in the Kwala Selangor outbreak and to a very large extent in the Kwala Lumpur outbreak. His earlier results seemed to indicate: (1) The cattle already infected had the disease in a milder form and that the percentage of recoveries were higher; (2) That animals inoculated previous to exposure to infection or which were not already infected did not become infected.

As regards the first of these the more extensive knowledge now gained shows that the serum does not appreciably mitigate the severity of the disease either in animals infected or in the stage of incubation, and that there is no appreciable reduction in the mortality.

As regards the second, with numerous provisoes and exceptions, it holds good for a limited period only.

With Indian bullocks out of 771 of those injected 54 cases, or 7.4 per cent., occurred over 10 days after injection though most of them were exposed to infection in the next two months.

The Siamese bullocks gave similar results. Not only as with the Indian bullocks did it have no effect if injected into animals already infected or in the incubation stage, but practically the same proportion, 39 out of 610, of those injected developed the disease more than 10 days after the injection and, therefore, had received the injection before infection occurred. Double the proportional dose was given with the Siamese cattle, as in the minimum with some groups the effect was so slight, but even with this dose though protection seemed to be conferred on some lots of cattle on others it was comparatively slight.

It appears that Siamese cattle, really cattle from widely scattered countries, vary greatly as to their susceptibility.

The effect of inoculation is illustrated by a comparison of the period which elapsed after removal from contact of an injected and non-injected herd. The injected herd were injected with double the minimum dose of serum the day they were removed from contact. The date of onset of the disease in both groups was determined by the rise of temperature.

Non-injected Herd.—Cases developed on the 4th, 6th, 15th and 17th days and 3 months later from fresh infection.

Injected Herd.—Cases developed on the 2nd, 3rd, 5th and 6th days and none later. In both groups the "contact" extended over a period of some days.

With Malay buffaloes the susceptibility is so great that small doses were obviously useless. A young Malay buffalo was given 10 times the proportional dose usually sufficient for protection with Siamese cattle and 20 times that which suffices for Indian cattle and the beast was then exposed to infection. It developed the disease in 5 days and died after 3 days illness. The same proportional dose was subsequently used by Mr. Ford for full grown buffaloes and no immunity resulted.

Though the value of the serum is limited it is still great, and simplifies the problem of dealing with an epidemic. By the use of serum in efficient doses only those cattle already infected and in the incubation stage are attacked, the others escape. The period of quarantine required is shortened, as with each fresh case a fresh period of quarantine would be required dating from the time of removal from contact with the diseased animal. Animals so protected are less liable to contract and, therefore, to convey the disease than animals unprotected.

Prevention.—The number of cattle imported at the various ports in the Federated Malay States per annum is some 2,000 cattle and about 5,000 buffaloes. Many others brought from a distance are landed at Straits Settlements ports, Malacca, and Prai, and marched overland into the Federated Malay States. Cattle are also marched across both the Northern and Southern boundaries. Effectual quarantine would, therefore, appear to be impossible, and on quarantine alone without provision for dealing with outbreaks occurring inland reliance cannot be placed.

The fact, however, remains, that two outbreaks were stopped at the quarantine station, and that with effective supervision at the port two others would probably have been stopped, and that one of these would have been stopped if notification of the disease in the great distributing port of Penang had been enforced.

Quarantine has been of value, and more thoroughly carried out would be of greater. As, however, the expense of large quarantine stations is considerable, and that without a thoroughly competent veterinary inspector are only of uncertain use, the advisability of limiting the number of ports at which bullocks can be imported is worthy of consideration.

Inoculation with serum at Penang and Singapore would reduce the risk of importation but not prevent it.

The main reliance after quarantine, in my opinion, must be on internal administration. Quarantine is valuable but at times must fail.

It is, I hope, clear that in these epidemics the difficulty in preventing the spread of the disease once it is introduced is the absence of early notification of the disease and the impossibility of ascertaining what transfers of cattle have been made.

As agents in spreading the disease the Malay buffaloes are less important than the bullocks, because they so rapidly become seriously affected and incapable of travel, and also on account of the shorter duration of their illness.

As regards both early notification of disease and knowledge of transfers of cattle much more supervision of the cattle sheds than is at present possible is necessary. Whether this is done by a Veterinary Police Force, by more numerous Veterinary Inspectors, or in what other way is, of course, an administrative matter, but it is essential that such supervision should be exercised habitually and not spasmodically on the occasion of an epidemic.

The Veterinary Staff for the two States, Selangor, 3,200 square miles, and Negri Sembilan, 2,600 square miles, consists of one Veterinary Surgeon for the two States. There is also one native Veterinary Inspector for Selangor.

The assistance of Sanitary Inspectors, Hospital Dressers, etc., can sometimes be obtained when there is any outbreak of disease, and others can under the same circumstances be engaged as temporary watchmen.

For practical purposes so small a skilled staff supplemented by unskilled auxiliaries is less efficient than a large trained staff would be, and in the long run less economical.

A system of registration of cattle and of the owners of cattle would enable an outbreak to be rapidly suppressed. This system if applied only to cattle and not to buffaloes would not be difficult to enforce and would enable any transfers to be followed. With such a system branding of the horns of adult cattle low down would probably be required.

If any fee were charged for such registration it should be small, as the object would not be for revenue but for the protection of cattle and their owners.

With any effective provision for early information of disease and of transfers from diseased herds I am of opinion that no serious spread of Rinderpest would take place even if the disease were frequently imported.

To deal with an outbreak rigid isolation of all diseased and certain contacts is necessary. The question of shooting such animals is raised with each outbreak and must be decided on according to circumstances. In the Kwala Lumpur outbreak the matter was considered. The Veterinary Surgeon was then away at Kwala Selangor dealing with the outbreak there, and in his absence my opinion was taken by the acting Health Officer. I decided against shooting either the diseased or contacts on the grounds that these animals could be satisfactorily isolated and spread of the disease from them prevented for the future, and that as the animals had been ill for some days probably infection had already been spread. That further outbreaks were probable and that the effect of shooting these convalescent animals would be to discourage the early notification of the disease for which we hoped. Our hopes were not fulfilled to any great extent, as few outbreaks were notified early, but as events showed shooting these animals would not have prevented or limited the outbreak.

The question of compensation for the destruction of animals is a difficult one. No doubt if full compensation were given for the destruction of animals earlier voluntary notification would take place, but I do not think that payment of compensation would make people more careful in preventing the spread of the disease, the expense to the State would be great, and

increased supervision and registration would serve the same purpose in a sounder manner and at less cost. Special cases, such as cases early in an outbreak, might, I think, receive special consideration, and an owner who reports early the first cases in an outbreak might be rewarded by full compensation for his losses or otherwise. The penalties for concealment of cases should be rigidly enforced, a minimum as well as maximum fine specified, and an informer should receive a portion of the fine.

The principle in isolating cattle in an outbreak should be to move the apparently healthy cattle from the sick ones and their surroundings, not the removal of the sick cattle. With each fresh case the herd should be moved and, as far as possible, subdivided into small groups. In this manner a large proportion of a herd will escape. Naturally this can only be done where there is abundant space, and then requires the erection of temporary sheds.

Removal of diseased cattle and thoroughly cleansing and disinfecting the sheds is less effective, but if the other method is impracticable is of some use.

The use of serum, as already pointed out, in effective doses should limit the spread of the disease to the cattle infected at the time of injection. In a future outbreak I think larger doses both for Indian and Siamese cattle should be used, even if this necessitates limiting the injection to actual contacts.

The universal inoculation with serum and either simultaneously or shortly after injecting with virulent blood is, in my opinion, impracticable in this country at present. It can only be practised during the occasional occurrence of Rinderpest, as virulent blood cannot be preserved. The doses of serum required for Malay buffaloes must be large, and for the various mixed breeds and for the cattle from various parts of the country are uncertain.

There would be serious risk that the disease might be widely disseminated by the method and that many of the protective inoculations would fail and that the mortality amongst those injected would be large.

The actual loss to the State and people of Selangor cannot be estimated only by the deaths amongst the animals. These were 350 to 400, of a value of some $40,000 or less. For one animal that died at least two were prevented from working for say two months, and the loss in earnings of these cattle, in wages of grass cutters, attendants, etc., was considerable. A serious loss to the public was the delay and inconvenience caused to public and private work by the necessary closing of roads and interference with cartage and traffic. The rise in the price of cattle and cartage has been considerable.

With the extensive clearings that now exist in various parts of the country there is no reason but the occurrence of these epidemics why cattle raising on both a small and a large scale should not be remunerative. The successful raising of stock would benefit the country, and the cessation of the large import trade in cattle diminish the risk of the introduction of the disease.

To conclude.—The disease is one which has been and probably will be imported from time to time, usually by sea. Some, perhaps the greater number, of these importations are preventable. If early notification of cases and early information of movements of cattle can be obtained even when the disease is imported its spread should be easily restricted and the direct losses from the disease small. For such a result a permanent annual expenditure for increased supervision would be requisite.

Note on Hydrophobia in Selangor, 1903 and 1904.

In a report by Dr. W. L. Braddon, State Surgeon, Negri Sembilan, on "*Rabies of an Indefinite Character amongst Dogs*," February 24th, 1902, an account is given of a small outbreak of this disease, and he concludes that: "(1) Dogs may have true rabies and yet exhibit no signs of illness by which the malady can be certainly diagnosed."

During the years 1903 and 1904, a considerable number of dogs, some alive and some dead, have been sent to the Institute to determine whether or not they had rabies.

The living animals were kept in a large cage and watched carefully. From the dead animals intradural injections of cerebral-spinal matter from the medulla were made into rabbits and, where possible, a history of the dogs was obtained.

The result of the observations is to confirm Dr. Braddon's result that the type of rabies in this country is atypical. Occasionally a typical case occurs.

In all twenty dogs were investigated at the Institute. Eight dogs were sent alive to the Institute but 3 of these were not cases of rabies, and after being kept for one or more weeks were returned to the owner.

In addition to the 5 cases under observation at the Institute one other was under observation outside. Twelve dogs were sent in dead suspected of having rabies; 6 of these had been killed and 6 had died naturally. Many of these bodies were more or less decomposed, and as a result of this decomposition in 3 cases rabbits injected from them died within 48 hours of septicæmia, thus vitiating the experiment so that no certainty was possible.

In 4 other cases the rabbits showed no symptoms and recovered completely, so that rabies could be excluded. In one case no rabbits were available.

Excluding these there were 9 cases of rabies as proved by post-mortem examinations and intradural injection of medullary substance from the dog.

Of these cases 2 occurred in July, and in the same month, but rather later, 2 cases occurred, one of the violent type of rabies and one of the paralytic form, in dogs outside and were certified as rabies by the Veterinary Surgeon who had seen them.

The next cases were in September, 1904, on the 15th and 21st respectively, and there were 3 cases in October, and one each in November and December and in January, 1905.

The other dogs who either recovered or in which no symptoms of rabies developed in injected rabbits were sent up both during the period when the cases of rabies occurred and in the intervening period.

In the case described by Dr. Braddon, a dog at large snapped at and bit a child, several dogs, and some goats. The dog had a few days previously been bitten by a snake, and it had been noticed that it had little appetite but had shown none of the mental change, alteration of disposition and demeanour usually described. On the following day the dog, though rather dull in demeanour and poor in condition, was perfectly tractable and obedient. It could be handled and showed no signs of irritability. There

was no excess of saliva in the mouth, and no appearance of weakness or loss of control over movement. The appetite was poor, but there was no difficulty in swallowing. No more definite signs supervened, but next evening it refused food and died on the following morning, 3 days after its short period of excitement.

The diagnosis of rabies was shown to be the correct one by the result of intradural injection into a rabbit by Dr. Braddon, and subsequently at the Institute Pasteur de Saigon by injections from a portion of the brain of the dog sent there by Dr. Braddon.

In the cases under observation similar deviations from the usually described forms of the disease occurred. In only one was there excess of saliva discharged from the mouth. In only one was there definite paralysis. The stage of excitement in most of them had probably been manifested before admission as the dogs had bitten other dogs or people but was either not present whilst under observation or was only present during a brief period which in two cases was late in the disease on the day of death, and in another on the third day over 24 hours before death. Loss of appetite, complete before death, was the only constant symptom. Death occurred in all cases and in from 3 to 5 days after the animal was first suspected of being ill. Several of the other dogs under observation showed more violent dispositions than those dogs shown to have rabies.

The diagnostic value of intradural injections was clearly shown. There are difficulties connected with it, as rabbits in the tropics appear more liable to disease, do not breed so fast, and are more difficult to rear than in temperate climates. Putrefaction is so rapid that unless a dog has been killed or died within a few hours of the examination the rabbits injected frequently die of septicæmia.

The virus of hydrophobia appears to be in a somewhat attenuated form in Malaya. The usual period of death after intradural injection in the rabbit was 17 to 18 days, and the earliest 15 days. As in Europe, the virus is intensified in passing through the rabbit, and the period after an intradural injection from one rabbit into a second rabbit was reduced to 12 to 14 days. Third injections were not performed on account of the scarcity of male rabbits.

A point of importance is the small number of cases in which the dogs bitten developed rabies. Out of a considerable number believed or known to have been bitten by these rabid dogs only 4 are known to have in turn become rabid, and the others, many of them under careful observation, have shown no signs of the disease. Of the four who developed the disease after being bitten by rabid dogs in two the period was rather short, 20 and 25 days respectively.

None of the human beings bitten by the dogs have developed rabies. Most of them were sent to the Pasteur Institute, Saigon, for treatment.

The rarity of the cases in which dogs bitten by the rabid dogs developed rabies may be due to the usual absence of salivation in the local variety of rabies. It is noteworthy that at the post-mortem examinations on the rabid dogs no marked enlargement or congestion of the salivary glands was found.

Whether rabies is endemic or not amongst dogs in the country cannot be stated. The occasional appearance of a group of cases with a long interval between, favours the supposition that it is not endemic, but imported

from time to time, but none of the diseased dogs had been recently imported. The jackal, the probable source of rabies in India, is not present in this country, and though no doubt carnivorous animals susceptible to the disease in its violent form exist in the country, there is little probability of dogs being infected by their bites. The Musang (Civet Cat) may possibly carry the disease in some cases.

A more rigid enforcement of the licensing enactments and destruction of unlicensed pariah dogs would, in my opinion, render the outbreaks less frequent and less prolonged. In the event of an increased Veterinary Staff or of a Veterinary Police Force this enforcement would naturally form a part of their duties.

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